Does relative strength in corporate governance improve corporate performance? Empirical evidence using MCDA approach

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Abstract

Academics and practitioners have developed different constructs to quantify corporate governance quality. Despite the limitations of the existing measures, they are still being commonly used. The literature finds that the relationship between performance and corporate governance quality can be positive, non-existing or even negative. To resolve this puzzle, we introduce a multi-criteria decision analysis (MCDA) approach to construct an alternative corporate governance quality synthesising companies' practices and mechanisms through an exhaustive pair comparison procedures based on outranking relationships analysis. Our approach compares the aggregate quality with a well-known corporate governance index, ASSET4 ESG in Thomson Reuters Datastream, using data for the U.S. firms. Using this MCDA approach based on PROMETHEE methods and econometric analysis, we obtain consistently a negative and strong link between firm performance and corporate governance quality. The findings are of particular interest to both scholars and decision makers including providers of corporate governance indices and rating agencies.

1. Introduction

Corporate governance is a decision making mechanism to control, monitor and manage companies. Although Brown et al. (2011) contend that there is no unifying theory to characterise corporate governance due to its multiple perspectives, some scholars outline that corporate governance puts in place internal mechanisms (e.g., board structure, board function, auditing and remuneration committees) to deal with agency problems (Clarke, 2004; Hart, 1995), or general organisations strategies (e.g., whether the governance and administration of the two societies would remain separate) (Keller & Kirkwood, 1999); and it is also enhanced by external instruments (e.g., investor protection and regulations) either to protect especially minority shareholders (Jensen, 1986; La Porta et al., 2000), or to produce benefits and wealth for the society as implied by the stakeholder theory, and long run perspectives through a trade-off between firm value and stakeholder benefits (Jensen, 2001; Mallin, 2013). In addition, corporate governance assures that companies allocate their resources according to their objectives and inter-corporate relationships. This framework is supported by the resource dependence theory, which suggests that firms function within a network constrained by other organisations' actions and decisions (Hillman et al., 2009; Tricker, 2012).

According to Bhagat et al. (2008) and Tricker (2012), corporate governance goes into the major decisions (e.g., takeovers, IPOs, financing structure, growth opportunities and payout policy). According to Elmir (2012), potential shareholders are not only aware of risks and returns but also of particular firm characteristics such as size, growth options, gearing and corporate governance to make their investment decisions.

Corporate governance has also been the centre of the major world scandals, involving unethical behaviour (Clarke, 2004), shared-value destruction (Tricker, 2012), and accounting fraud (Bhagat et al., 2008), to name some. Particularly, during the recent financial crisis many problems in corporate governance were uncovered, which are notably associated with executive remuneration, regulation, transparency, risk management, auditing, and market behaviour (Kieff & Paredes, 2010; Mehran et al., 2011; Tricker, 2012; Vander Bauwhede & Willekens, 2008). Because of these scandals, the level of scrutiny of corporate governance practices has been increasing (Chahine & Zeidan, 2014; Matoussi & Jardak, 2012). As a result, academics such as Bebchuk et al. (2006); Bebchuk et al. (2002); Brown & Caylor (2006); Gompers et al. (2003) and data providers and consulting firms such as Risk Metrics and Institutional Shareholder Services (ISS) (Bhagat & Bolton, 2008; Bhagat et al., 2008; Ertugrul & Hegde, 2009) and Thomson Reuters (ASSET4 module in Datastream) shown

by Ribando & Bonne (2010) provide different measurements to report how companies are dealing with governance and their control mechanisms.

To date, there has been little consensus regarding the consistency, setting and construction of corporate governance indices, and whether they influence firm performance. For instance, Bhagat et al. (2008) and Tricker (2012) argue that corporate governance has multiple perspectives dictated by macroeconomic, country-specific and legal factors as well as firm-specific factors; Black et al. (2017) examine the construct validity of such indices in emerging markets; Mehran et al. (2011) state that it varies across financial and non-financial sectors; Lehmann & Weigand (2000) contend that governance practices are related to ownership concentration. Furthermore, because of stickiness and lack of change in some corporate governance aspects (i.e., duality and board size), and methodological endogeneity issues (i.e., unobserved heterogeneity and bidirectional relationship between corporate governance and firm outcomes), evaluating whether corporate governance affects firm performance proves challenging (Acharya et al., 2013; Bebchuk et al., 2006; Bhagat & Bolton, 2008; Bhagat et al., 2008; Wintoki et al., 2012). The issue of synthesising these multidimensional perspectives has been portrayed by scholars (Acharya et al., 2013; Adjaoud & Ben-Amar, 2010; Brown et al., 2011; Chen et al., 2007; Larcker & Tayan, 2011; Renders et al., 2010; Tricker, 2012). Similarly, Daily et al. (1999) highlight the issues related to the measurement of corporate board composition and the conflicting findings in the literature regarding the effect of board composition on firm performance. As a consequence, we propose the multi-criteria decision analysis (MCDA) approach,[1] using PROMETHEE methods (Brans et al., 1986; De Keyser & Peeters, 1996), combined with econometric analyses of panel data to determine whether a new multicriteria index of corporate governance provides more robust findings that would shed light on the puzzle of corporate governance and firm performance link, which can be deemed as a new multidisciplinary context. Most studies in corporate governance have only been carried out unidimensionally either by focusing on global indices or a particular aspect (i.e., CEO duality, board structure and voting rights). However, the process of scrutinising companies' differences and interrelationships, and computing their aggregated differences in

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[1] The MCDA approach is extended and applied to other fields for further dissemination of knowledge in the operations research literature. For example, Oliveira et al. (2017) examine the propensity of firms becoming insolvent; Poplawska et al. (2017) focus on the quantification of corporate social responsibility decisions; Doukas et al. (2007) use the linguistic variables on innovative energy technologies; Ferreira et al. (2011) evaluate bank branch performance; Hayashida et al. (2010) examine effective policies for financing activities to preserve forests; Cohen et al. (2012) evaluate the financial viability and distress of municipalities; Galariotis et al. (2016) introduce a multi-attribute financial evaluation to analyse municipalities; Fukuyama & Matousek (2017) evaluate banks' network revenue efficiency on non-performing loans, and Walczak & Rutkowska (2017) propose automated comparisons of participatory budget projects.

relative terms has received little attention. In addition, the research to date has also created a puzzle in terms of the impact of corporate governance indices on company performance, by which we believe it is the consequence of not taking into consideration the dominance of relationships among companies.

We raise several research questions: if corporate governance is a fully heterogeneous environment of mechanisms and practices across countries and industries, is it possible to determine this difference to figure out the best implementing companies? If the answer is affirmative, are they the best performing companies or do their relatively high compliance practices with corporate governance undermine financial performance? Are the results robust to endogeneity concerns and consistent across various sub-samples? Otherwise, for instance, is it possible to determine and contrast whether a traditional corporate index provides more explanatory power and statistical significance than an aggregate measurement based on multi-criteria analysis does?

With respect to these questions, the challenge that this paper has taken is to synthesise different corporate governance disclosures (practices and mechanisms), compute differences among companies on their respective industry group, and consequently determine an aggregate quality of corporate governance. Based on these outputs, it is possible to determine whether the better controlled and addressed companies can be matched to better performing companies. Although previous studies rely on weighted average, statistical models, or Z-score approaches to construct corporate governance indices (Bhagat et al., 2008; Daines et al., 2010), which lack incorporating companies' relative differences among their peers, and providing significant explanation of company performance, we employ particularly a MCDA approach based on the use of PROMETHEE methods (Brans & Mareschal, 2005; Brans et al., 1986; De Keyser & Peeters, 1996), a well-known method that helps us to construct an aggregate quality of internal corporate governance, considering inter and intra-industry heterogeneities through an exhaustive outranking analysis among companies, which attempts to complement traditional corporate governance indices and frameworks. The proposed approach is implemented on a large panel data set which includes the US firms covered by ASSET4 ESG (Datastream) during 2002-2014, totalling 10,171 firm-years and 5,271,380 pair comparisons.

The results obtained from the MCDA approach lead to a number of interesting and robust findings, and to some practical implications that are also generalisable. First, it provides fresh evidence that superiority or dominance relationships synthesised in an aggregate quality of corporate governance explains adequately

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company performance, which is statistically significant and shows good explanatory power, in contrast to a proprietary index reported by Thomson Reuters Datastream. Second, the proposed approach reduces the heterogeneities among companies and their peers, because by construction, the aggregate function reduces the corporate governance differences to net outranking flows computed by distance measures among pairs of companies. Our MCDA approach reveals that the effect of aggregate quality that we measured is negatively associated with firm performance, which implies that having higher level of compliance, reporting and standards with corporate governance can reduce profitability due to associated costs.

Our paper proceeds as follows. Section 2 presents the MCDA approach. Section 3 provides the methodology associated with data selection, corporate governance index and aggregate quality of corporate governance, explanatory variables and regression models. Section 4 presents and discusses the results. Section 5 highlights some further considerations to evaluate the consistency in findings. Section 6 concludes the paper and outlines some future research directions.

2. Multi-criteria analysis approach

2.1. Modelling setting

Corporate governance has been the focal point to evaluate companies in terms of agency problems, risk management, firm performance, accounting and auditing practices, shareholder protection, value creation and joint ventures. Some authors acknowledge that corporate governance practices help managers and shareholders to work in harmony (Martynova & Renneboog, 2011), other simply create the basics to assess whether the governance and administration of the two societies would remain separate, for example, Operations Research Society of America (ORSA) appointing key personnel as committee chairs, while The Institute of Management Sciences (TIMS) electing key representative as VP-Publications (Keller & Kirkwood, 1999). However, at corporate level corporate governance has also been the centre of the major scandals worldwide. For instance, Bhagat et al. (2008) mention Enron's accounting manipulations, and Enriques & Volpin (2007) analyse the diverting funds by Parmalat.

Market participants tend to look for companies with good governance practices, and scholars and private companies play a pivotal role in developing corporate governance measurements, composite and aggregate metrics in order to increase the dissemination of information and transparency to the financial market. Therefore, Weir et al. (2002) state that corporate governance has two main perspectives. The first is external

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corporate governance associated with the market for corporate control (Jensen, 1986; La Porta et al., 2000), for example, law and investor protection. The second is internal corporate governance related to aspects such as board structure, board function, executive ownership and compensation (Bhagat et al., 2008; Hernandez-Perdomo et al., 2019; Walsh & Seward, 1990).

In contrast to the external corporate governance, the internal perspective changes rapidly among industries and their constituents firms. As a result, companies tend to follow the best practices and codes (Cole, 1993; OECD, 2004), and consequently, report their stages of compliance. This information is blended in indices by academics and private data providers, who assess and construct multiple corporate governance perspectives. For the group of academics, we have the G-Index (Gompers et al., 2003) and E-index (Bebchuk et al., 2006; Bebchuk et al., 2002) using external statistical scales and additive weighted aggregations, or Larcker et al. (2007) using principal component analysis (PCA). For the group of private data providers, we have the Institutional Shareholder Services (ISS) (Bhagat et al., 2008; Larcker & Tayan, 2011), Deminor rating (Renders et al., 2010) and ASSET4 ESG data from Datastream (Ribando & Bonne, 2010) using Z-scores and predefined ranges.

Some scholars highlight the limitations associated with corporate governance indices. Markedly, Larcker & Tayan (2011) affirm that they are based on total scores and sum of weighting points which are highly sensitive to the predetermined scales. Brown et al. (2011) and Schnyder (2012) remark the stickiness problems (i.e., some corporate governance outputs do not change for a long time). Consequently, these limitations lead to a lack of statistical significance in corporate governance studies. Bhagat et al. (2008), Mehran et al. (2011) and Schnyder (2012) point out that corporate governance metrics are developed by firm-specific factors mostly correlated with the outcome of interest (i.e., performance, risk, growth opportunities), and a simpler aggregate index is unable to account complex corporate governance dynamics (i.e., interactions and differences in terms of corporate governance practices) across industries and countries.

Although these indices suffer from some limitations, scholars continue to use them for their theory building in search of the corporate governance & performance nexus. Notably, Bhagat & Bolton (2008) and Bhagat et al. (2008) examine this issue by regressing return on assets (ROA) on different corporate governance indices (academic or proprietary), but without providing conclusive evidence. Also, Ertugrul & Hegde (2009) do not identify strong relationships among companies' ratings and corporate governance practices. Nonetheless,

Chahine & Zeidan (2014) conclude that companies with good governance slightly outperform the others. Although the findings in the literature may be true, conclusive or not, the key problem with corporate governance indices with such limitations is that scholars and investors are using them to find out whether good governance implies good performance and vice-versa, without evaluating other frameworks, methods, or functional forms.

Acknowledging the limitations of the existing corporate governance indices (see Black et al., 2017), this research revises alternative approaches to consider the indices' specific characteristics, company-specific schemes, and differences across industries and countries, metrics stickiness, which are the current problems highlighted in the literature. For instance, this study considers decision making models, which rely on MCDA techniques (Bouyssou et al., 2006; Brans & Mareschal, 2005; Roy, 1996; Saaty, 2013; Yager & Alajlan, 2014; Zeleny, 1982) in order to introduce relevant means to obtain an alternative aggregate quality based on multiple perspectives (indicators or criteria).

Among the MCDA methods, various methods have been reported by the literature: outranking methods (i.e., preference ranking organisation method for enrichment evaluations (PROMETHEE) (Brans & Mareschal, 2005; De Keyser & Peeters, 1996) and ELECTRE methods (Andriosopoulos et al., 2012; Brans & Mareschal, 2005; Gaganis et al., 2010; Xidonas et al., 2009)), MAUT –multi-attribute utility methods– (Abbas & Sun, 2015; Keeney & Raiffa, 1976; Schmitt et al., 2003), and AHP –analytical hierarchy process– (Saaty, 2003; Saaty & Shang, 2011; Saaty, 2013), OWA operators –ordered weighted average–(Yager, 2009; Yager & Alajlan, 2014), multi-attribute benchmarking method (Galariotis et al., 2016), among other methods.

Although these methods have not been implemented to compute an aggregate quality of internal corporate governance, the guidelines provided by the multi-attribute benchmarking method used by Galariotis et al. (2016) evaluating financial performance of local governments helps us to visualise the possible implications of multi-criteria analysis considering panel data sets and regression analysis. However, we contend that this method cannot be used directly because it assumes trade-off among the attributes and uses additive evaluations without evaluating the intensity of preference among alternatives, aspects criticised by researchers in corporate governance studies.
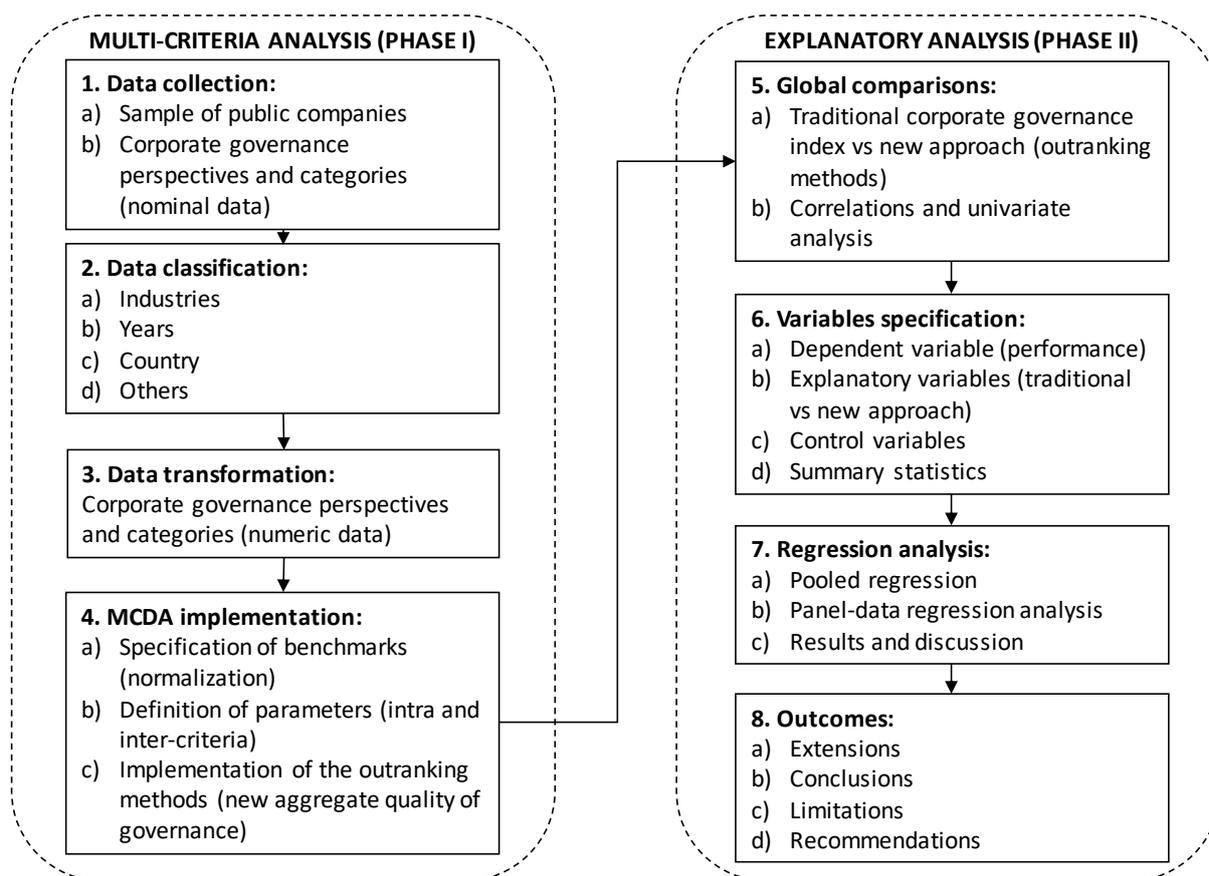
Furthermore, the outranking methods, especially PROMETHEE methods, seem to be feasible because Brans et al. (1986), De Keyser & Peeters (1996), Brans & Mareschal (2003; 2005), Behzadian et al. (2010),

Bagherikahvarin and De Smet (2017), and Rocco et al. (2016), among others, mention that they allow us exhaustively to analyse the outranking relationships, intensity of preferences, and dominance and non-dominance interactions among alternatives using pairwise comparisons. Namely, outranking methods help to compute the dominance relationships among alternatives using, in general, a non-compensatory approach based on distance measurements. However, in order to apply PROMETHEE methods a previous evaluation is required, which is common in finance and economics studies to compare the companies, normalise the data and select appropriate reference values (i.e., industry references, peer comparisons and targets firms) (Core et al., 2006; Galariotis et al., 2016; Platikanova, 2016). Consequently, the proposed MCDA approach relies on the definition of proper reference values and outranking methods to compute the aggregate quality of corporate governance.[2] This new score intends not only to overcome the limitations and heterogeneities of traditional corporate governance indices but also to test whether this new approach reveals significant information in terms of company performance using regression analyses. To our best knowledge and revising Behzadian et al. (2010) and Mareschal (2015), this novel approach has not been presented elsewhere. Therefore, the ASSET4 ESG index is going to be utilised in this research, which not only has been used widely in the literature but also because it suffers from the same limitations of other traditional measurements (i.e., "black box" construction, weighting adjustments, unsupported trade-offs, among other aspects).

Similar to the guidelines of Galariotis et al. (2016) associated with the procedure to link an MCDA approach to empirical analyses (theoretical support and statistical significance), Figure 1 outlines our methodological approach for corporate governance analysis for listed companies, which consists of two stages: the first phase involves collecting, classifying and transforming the corporate governance information (companies, years, indicators, and perspectives). Therefore, this data set is used to implement the outranking methods to estimate the new aggregate quality of corporate governance that is going to be compared against a traditional corporate governance index provided by a data vendor.

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[2] PROMETHEE output is a set of values based on which it is possible to rank alternatives and show the resulting rank. Yet, we ought to note that the motivation and priority of our paper is the general behaviour of the system rather than a single company (see e.g., Hernandez-Perdomo et al., 2019).

MULTI-CRITERIA ANALYSIS (PHASE I)

1. Data collection:
a) Sample of public companies
b) Corporate governance perspectives and categories (nominal data)

2. Data classification:
a) Industries
b) Years
c) Country
d) Others

3. Data transformation:
Corporate governance perspectives and categories (numeric data)

4. MCDA implementation:
a) Specification of benchmarks (normalization)
b) Definition of parameters (intra and inter-criteria)
c) Implementation of the outranking methods (new aggregate quality of governance)

EXPLANATORY ANALYSIS (PHASE II)

5. Global comparisons:
a) Traditional corporate governance index vs new approach (outranking methods)
b) Correlations and univariate analysis

6. Variables specification:
a) Dependent variable (performance)
b) Explanatory variables (traditional vs new approach)
c) Control variables
d) Summary statistics

7. Regression analysis:
a) Pooled regression
b) Panel-data regression analysis
c) Results and discussion

8. Outcomes:
a) Extensions
b) Conclusions
c) Limitations
d) Recommendations

Figure 1. Outline of the methodological approach

The next step involves the explanatory analysis by which both corporate governance approaches (traditional and current) are evaluated through univariate and multivariate analyses; similar perspective is reported by Bhagat et al. (2008) comparing either traditional indices or corporate governance ratings. The regression models are specified according to the information available, theoretical background, and variables (dependent, explanatory and control) reported in the literature (e.g., Alimehmeti & Paletta, 2014; Bhagat & Bolton, 2008; Brown & Caylor, 2006; Brown et al., 2011; Renders et al., 2010; Wintoki et al., 2012). It allows evaluating and contrasting the explanatory power of the models, and statistical significance of the aggregate quality of governance and traditional governance index to explain company performance, being in line with the previous literature on this matter.

Finally, through the regression models, we can observe not only if the dominance relationships among companies using this new MCDA indicator explain firm performance but also establish conclusions and recommendations for regulators, decision makers, and investors in terms of monitoring and evaluating corporate governance mechanisms and practices.

2.2. Multi-criteria decision analysis model

Considering a panel data setting, we assume that corporate governance information can be modelled using an outranking relationship[3] framework (Bouyssou et al., 2006; Brans & Mareschal, 2003, 2005; Corrente et al., 2014), based on PROMETHEE methods and defining the ideal values from the best companies among criteria, industry, and year at once, to configure an aggregation function F for a set of m listed companies $a_i \in A$ ($i = 1,2,...,m$) as $g(a_i) = F[g_1(a_i), g_2(a_i), ..., g_n(a_i)]$ on n multiple corporate governance criteria (g_j). For instance, comparing company a (as a vector) with its peers x ($a, x \in A$) from an industry s in year t, can be synthesised through the following model:

$$AQCG_s^t(a) = \frac{1}{(m-1)} \sum_{j=1}^{n} \sum_{\substack{x \in A \\ x \neq a}} [P_j(a,x) - P_j(x,a)]_s^t RI_j \qquad (1)$$

where:

- $AQCG_s^t(a)$ is the aggregate quality of corporate governance based on dominance relationships among companies. This new approach allows us to analyse corporate governance mechanisms and practices to determine the relative quality of a company in these respects, which can then be related to company performance. Operationally, equation (1), defined as the net flow in PROMETHEE methods, represents for each company: "credit" for a company outranking others, and "debit", otherwise.

- $P_j(a,x)$ is the result of performing all pair-wise comparisons between a company and their peers (and vice-versa $P_j(x,a)$) in their respective industry and by year. It is based on the performance difference $d_j(a,x)$ for a selected criterion g_j, which represents the preference intensity of the calculated deviation. This means that, for each criterion g_j, decision makers have a preference function for two alternatives as below:

$$P_j(a,b) = GC_j(d_j(a,b)) \ \forall a,b \in A \ (\text{for } j = 1,2,...,n) \qquad (2)$$

$$0 \leq P_j(a,b) \leq 1 \qquad (3)$$

$$d_j(a,b) = g_j(a) - g_j(b) \qquad (4)$$

where $GC_j()$ is one of the generalised criterion (GC) functions defined in Brans & Mareschal (2003).

For minimization purposes, preference function (2) can be obtained by symmetry (Brans & Mareschal, 2003) as $P_j(a,b) = GC_j[-d_j(a,b)]$.

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[3] The outranking relationship, denoted as S, does not determine if the relationship between two alternatives a and b is a strong preference (aPb), weak preference (aQb), or indifferent (aIb), but instead it establishes if "the alternative a is at least as good as the alternative b" (Brans & Mareschal, 2005).

- GC_j models whether the difference between two companies can generate enough reasons to establish an order. Brans & Mareschal (2003; 2005) have proposed six types of GC. However, because there is a general concern in corporate governance studies associated with stickiness and lack of variability in the "*status quo*" of some indicators reported by companies (Brown et al., 2011), we select the GC type I strict or usual criterion: $\left(F(x) = \begin{cases} 0 & x \leq 0 \\ 1 & x > 0 \end{cases} \right)$ that requires no additional parameter definition), which contends that strict criterion can identify any difference between two alternatives[4], no matter how small it might be (Rocco et al., 2016).

- RI_j is a set of importance values or decision makers' preferences over the selected corporate governance criteria (i.e., criteria weights Keller & Kirkwood (1999)), where $\sum_{j=1}^{n} RI_n = 1, RI_n \geq 0$ are the relative importance among the corporate governance perspectives under evaluation. In this paper, we do not consider differentiated values for no skewing or outweighing some corporate governance particularities. Similar approaches have been used by Doukas et al. (2007), Hayashida et al. (2010), Hu & Mehrotra (2012), and Walczak & Rutkowska (2017). They emphasise that, as in any other methodological approach in MCDA, if any additional information is available (e.g., decision makers provide it), the models should consider it.

It is important to emphasise that the corporate governance impacts a_i (*i = 1,2,…,m*) evaluated on criterion g_j (*j = 1,2,…,n*) could be compared against a reference value a^* (e.g., maximum, ideal, or goal value) on the *j*-criterion selected $g_j(a^*)$. The relevance of this comparison is justified by Galariotis et al. (2016) and it is also useful as far as for decision making by corporate managers and investors. Furthermore, this approach follows a normalisation procedure, across the data range under analysis, which is explored by Zeleny (1973; 1982), who underlines that the closer the alternatives to the target goals the more preferred they are. This is a rational expression of the human behaviour.

Finally, to the best of our knowledge, the proposed $AQCG_s^t(.)$: i) provides useful insights as it helps to evaluate whether corporate governance mechanisms and outranking relationships among companies affect firm performance; ii) can be compared to the traditional governance indices, especially the governance scores

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[4] Other GC types too might be used. However, they require additional information either from decision makers or from the data such as information about the parameters to model the threshold of indifference among objects or strict preference. We thus consider the GC "type I" since no additional information is required. Besides, our choice allows considering small differences for the corporate governance evaluations among the incumbent companies. Further research regarding other types of GC needs to be developed considering that preference and indifference values among the companies is going to be relaxed, and the statistical significance and explanatory power of the regression models might be affected.

(ASSET4 Environmental, Social & Governance (ESG) data reported by Thomson Reuters Datastream), which follows a "black box" construction and a simple weighted average adjusted by a Z-score function; and iii) overcomes the significant limitations (e.g., overweighing criteria, compensations, stickiness) of other data providers for corporate governance indices (Bhagat et al., 2008; Daines et al., 2010; Larcker & Tayan, 2011; Schnyder, 2012).

3. Methodology

3.1. Data

Our dataset consists of 1,203 listed U.S. companies that have corporate governance information in Datastream and are used for the corporate governance score (ASSET4 ESG module). For corporate ownership related variables, we benefited from Thomson Reuters EIKON. Following the data vendor companies, we adopt 10 economic sectors according to the International Standard Industrial Classification (ISIC). The companies are selected from 2002 onwards since ASSET4 ESG data started to be available in that year and our data collection ends in 2014. The original sample contained 15,639 company-year observations, and after correcting it for the usual filtering such as missing, duplicates and unavailable information, the final data includes 10,171 firm-years as shown in Table 1.

[INSERT TABLE 1 HERE]

3.2. Index and aggregate quality of corporate governance

Datastream presents a corporate governance index in the ASSET4 ESG module for listed companies in the USA. The ASSET4 ESG database starts comprising information from 2002, and its index takes into consideration 33 governance practices and mechanisms reported by companies, which at the same time belong to five perspectives (i.e., board structure, board function, compensation policy, shareholder rights, and vision and strategy). These perspectives are the attributes under scrutiny for our MCDA approach to get an aggregate quality of corporate governance.

In order to understand how a proprietary corporate governance index ("black-box") and an aggregate quality from MCDA ("white-box") can be contrasted, aspects like data transformation, weighting, reference values and normalisation deserve some considerations as below.

3.3. Corporate governance index

Although the numerical data are not provided by Datastream, it is stated that corporate governance indicators or categories in ASSET4 ESG module are transformed from nominal values (i.e., Yes, Yes/Yes, No, Yes/No, No/Yes, N/A, No/No, N/R (Not Relevant), etc.) to numeric values using positive and negative polarity possibilities (e.g., 0, 0.5, and 1), normalised using Z-scoring, and weighted by regions (e.g., Africa, Latin America, Europe, USA and Canada) using diverse approaches. Subsequently, each corporate governance indicator is adjusted by a relative level of importance (RLI) from 0 to 5 considering the level of reporting, data range, skewness, standard deviation, independent information content, and so forth. In the end, all indicators become dimensionless, and no further normalisation is required. Note that adjustments, weights, transformation from nominal to numeric information, among other aspects, are considered as a "black box", as well as other proprietary indices shown by Bhagat et al. (2008) and Daines et al. (2010), among others.

In addition, scholars use either corporate governance indices or the practices and mechanisms reported, single or grouped, to create new variables and/or weighted indices, especially, to see whether corporate governance affects firm performance (Acharya et al., 2013; Bebchuk et al., 2006; Bhagat & Bolton, 2008; Bhagat et al., 2008; Wintoki et al., 2012). However, the results are not fully satisfactory in terms of explaining variation in firm performance and overcoming the weighting bias (e.g., fully compensatory) forms of aggregation criteria of corporate governance information.

3.4. Aggregate quality of corporate governance index

In order to evaluate the corporate governance perspectives via our MCDA approach, the following stages are performed: In the first stage, 33 categories and five perspectives of corporate governance were revised and explicitly converted from nominal to numeric values. Table 2 shows these perspectives, in particular, their definitions and categories, descriptions from the companies' perspectives, methodology for nominal-to-numeric transformations, additional adjustments considered, and relevant references supporting non-straightforward considerations according to best practices in corporate governance form (see Cole, 1993; OECD, 2004). Therefore, some firm indicators are quantified by using industry information or based on the academic literature or practitioners' evidence. For instance, let's consider the indicator of experience (average number of years each board member has been on the board): decision makers know, from the best practices, that more board experience in a given industry is always important for good governance. Thus, we used the

industry average as a reference value to define the rating in that indicator. The proposed MCDA approach also allows decision makers to introduce other available reference points.

In the second stage, the numeric values associated with the corporate governance criteria are aggregated on their corresponding perspectives using the sum of numeric evaluations divided by the number of categories contained. Similar approaches are proposed by Saaty (1980; 2003; 2013) who aggregates multiple interrelated attributes using hierarchical structures. It is important to mention that the relative importance or weights associated with the corporate governance perspectives (final macro-criteria) are not taken into consideration in this research as they can bias or produce undesired out-weights in the final outcomes. This limitation is also inherent in some academic indices (Bhagat et al., 2008; Larcker & Tayan, 2011). Alternatively, because we are interested in contrasting the traditional corporate governance index (Datastream) against the aggregate quality of corporate governance, some additional data revisions and adjustments were considered regarding unavailable or incomplete information. For instance, in our approach, i) if a company reports the corporate governance index in Datastream but does not report information in a specific category, value of zero is assigned; ii) if within the same industry two or more companies report information about a specific corporate governance practice but one company does not (i.e., "NA") then this company receives score of zero in order to reflect the best practices (transparency and reporting). Otherwise, "NA" is considered as missing value.

Although all indicators result in a common unit, decision makers could also introduce other standardization perspectives from the field of MCDA. Notably, some of them are proposed by Zeleny (1973; 1982) for multicriteria compromise programming, which allows considering other values such as maximum, minimum, ideal, or goal values to standardize a given indicator. This relative approach means that the closer the alternatives to the given targets the more preferred they are. For example, a decision maker might prefer normalising all data points related to a particular "preferred" percentage of board diversity.

In the final stage, the outranking analysis and the pair comparisons approach, supported on the obtained numeric values for each corporate governance perspective, are implemented to analyse the dominance and dynamics relationships among peer companies relative to their industries. This process helps to compute exhaustively the intensity of preferences among companies using distance measurements and generalised criteria, which is, in general, at the same time a non-compensatory approach (Bouyssou et al., 2006; Brans & Mareschal, 2005; Roy, 1996). However, due to the PROMETHEE model selected (see section 2.2) the non-

compensatory characteristic is not considered. Finally, this "white box" can be considered as a unique and novel procedure, and opens new implementation perspectives for other MCDA methodologies used in the current literature.

3.5. Preliminary outcomes on corporate governance and the MCDA approach

Additional to firm-related factors (panel B), Table 3 presents the summary statistics for various corporate governance dimensions (panel A). The first one is the traditional corporate governance index (*ncgvi*). Also, we report the five perspectives of corporate governance following the transformation and adjustments described in Table 2, which are the board structure (*bs_d*), the board function (*bf_d*), compensation policy (*cpoly_d*), shareholder rights (*shrt_d*), and vision and strategy (*vstr_d*). Therefore, the linear weighted average of these perspectives is shown by *cgvi_d*. Furthermore, our MCDA approach combines these five aspects by using outranking relationships in order to generate an aggregate quality of corporate governance (*aqcg_d*) and the results of the MCDA approach are based on nearly 5.3 million pair comparisons.

[INSERT TABLES 2-3 HERE]

It is important to notice that Table 3 reveals that during 2002-2014, on average, the U.S. firms' corporate governance index (*ngcvi*) is above 70%. On the other hand, the proposed aggregate quality of corporate governance (*aqcg_d*), unveils a higher dispersion in contrast to the traditional governance index (*ngcvi*). The MCDA approach entails the following comments:

1) By construction, PROMETHEE methods standardizes the differences among companies based on the flows of the firms who dominate or outrank others (positive flows), netted by firms that do not support this dominance relationship (negative flows). Then, averaging the net flows produces small figures. Although we only employ the information from the MCDA index[5] by company in the econometric analysis, these averages are able to detect small changes in corporate governance information across years and industries.

Figure 2 shows the behaviour of the traditional and MCDA indices by year and by industries. While the proposed index reveals that, on average, companies had some low corporate governance quality during 2002-

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[5] As for the corporate governance index in ASSET 4 ESG, there is no additional information for differentiated weights of criteria (perspectives). However, the MCDA approach can also consider different weights if they are justified either theoretically or empirically, and results might change. As Cohen et al. (2012) state, if the MCDA approach requires subjective judgments about the parameters of the evaluation process and these factors should reflect the judgment policy of decision makers. However, this approach into our research is not appropriate due to the lack of access to decision makers or actual users of the aggregate quality of corporate governance indices. Nevertheless, in order to mitigate the concern associated with the lack of grey area we changed the definition of constructs in Table 2 that are based on the comparison between firm average and industry average figures. This robustness check (results are not reported here but available on request) confirms that our findings remain qualitatively the same.

2014 (i.e., years with negative MCDA index) with significant variation across years, the traditional index fails to detect this situation. The MCDA index reveals also which industries (i.e., 1, 2, 4, 7, and 9) contain companies that- relative to their respective industry peers- were not well managed according to the corporate governance perspectives considered. The traditional index fails again to identify this observation.[6] Figure 3 and Figure 4 provide a better visual aid through the comparison among companies.
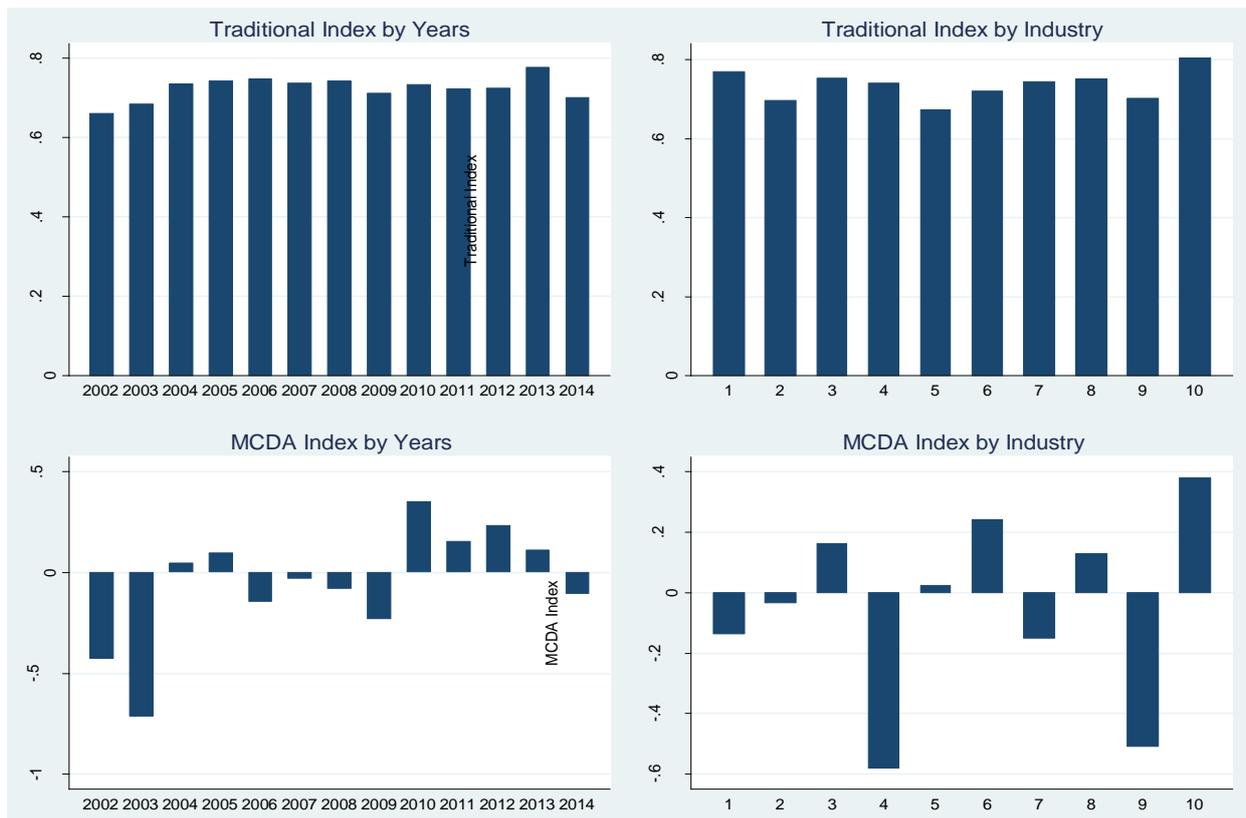

Figure 2. Average corporate governance index by industries and years during 2002-2014 using two approaches.

2) The outranking analysis allows to contrast the traditional corporate governance index against the MCDA approach using a panel data structure across firms and controlling by years and industries. For instance, by arbitrarily selecting six companies with the following data identifiers (ID-50, ID-116, ID-162, ID-233, ID-285, and ID-690) from the energy industry, Figure 3 shows that most of them have, on average, a traditional governance index above 60%; however, the MCDA index shows that there are some companies with negative

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[6] The MCDA index yields relatively highly negative figures in years 2002 and 2003. The reason could be: the Sarbanes-Oxley Act-enacted in 2002-stipulated very strict corporate governance practices to improve accountability, responsibility and transparency and the contention is that its financial costs and regulatory burden decelerated the speed of adjustment of firms to comply with this Act (see e.g., Engel et al., 2007; Zhang, 2007). Such negative figures are observed for energy and telecommunication industries. One possible explanation for this is that these industries are highly regulated by strict compliance processes regarding the environment and social responsibility, and shareholder protection, which could constrain their aggregate quality. The other explanation could be that it is less costly for regulated companies if they do not fully comply with the corporate governance codes at least because such firms do not suffer that much from information asymmetry between insiders and outsiders, compared to the firms in other industries.

values (e.g., ID-162 and ID-285) in relation to their industry peers in some years. As Andriosopoulos et al. (2012) and Gaganis et al. (2010) indicate (describing the assumptions on the outranking methods), these companies are not at least as good as the other companies in terms of corporate governance practices and mechanisms. Hence, these outranking relationships among companies, specified in total net flows from the corporate governance outcomes, might provide better explanatory power and statistical evidence regarding firm performance. This occurrence is not easily observed on full linear weighted averaging indices shown by the literature (see e.g., Wintoki et al., 2012; Daines et al., 2010; Renders et al., 2010; Bhagat & Bolton, 2008; and Bhagat et al., 2008).
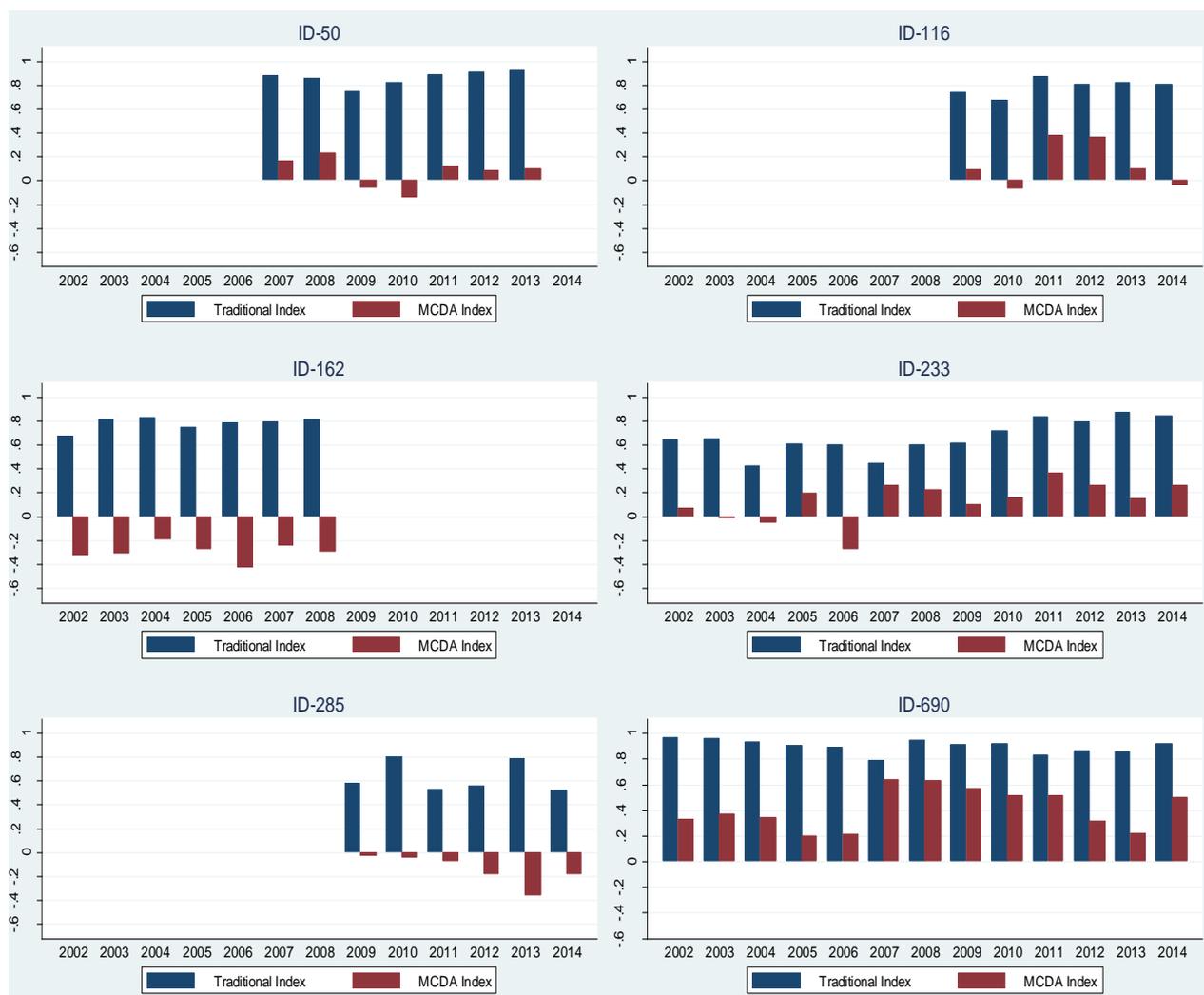
Figure 3. Corporate governance (traditional index vs. MCDA index) for selected companies in the energy industry.

3) The MCDA approach also allows drilling down on the related corporate governance perspectives in order to visualize one of the main concerns about the traditional corporate governance scores. For example, from Figure 4, considering companies ID-50, ID-285 and ID-690 from the energy sector, it is possible to observe

that company ID-285 has a lower performance on the perspective vision and strategy (*vstr_d*) during 2012-2014, and the traditional approach grades this company with at least 50%, on average, in the governance score. Particularly in 2013, ID-285 is closer to 80% in the traditional governance score. However, our MCDA index finds that this company cannot be as good as the other industry peers since it reports negative figures. In addition, note that both ID-50 and ID-690 outrank ID-285 in different governance perspectives; however, ID-50 is not at least as good as ID-690, which dominates them in most of the corporate governance perspectives. In terms of pair comparisons, it is important to realize that the proposed aggregate quality of corporate governance also considers information about whether the other peers provide enough arguments to confirm or refute the outranking relationship of a given company. In fact, we argue that the proposed index is more consistent in comparing companies across different corporate governance perspectives.
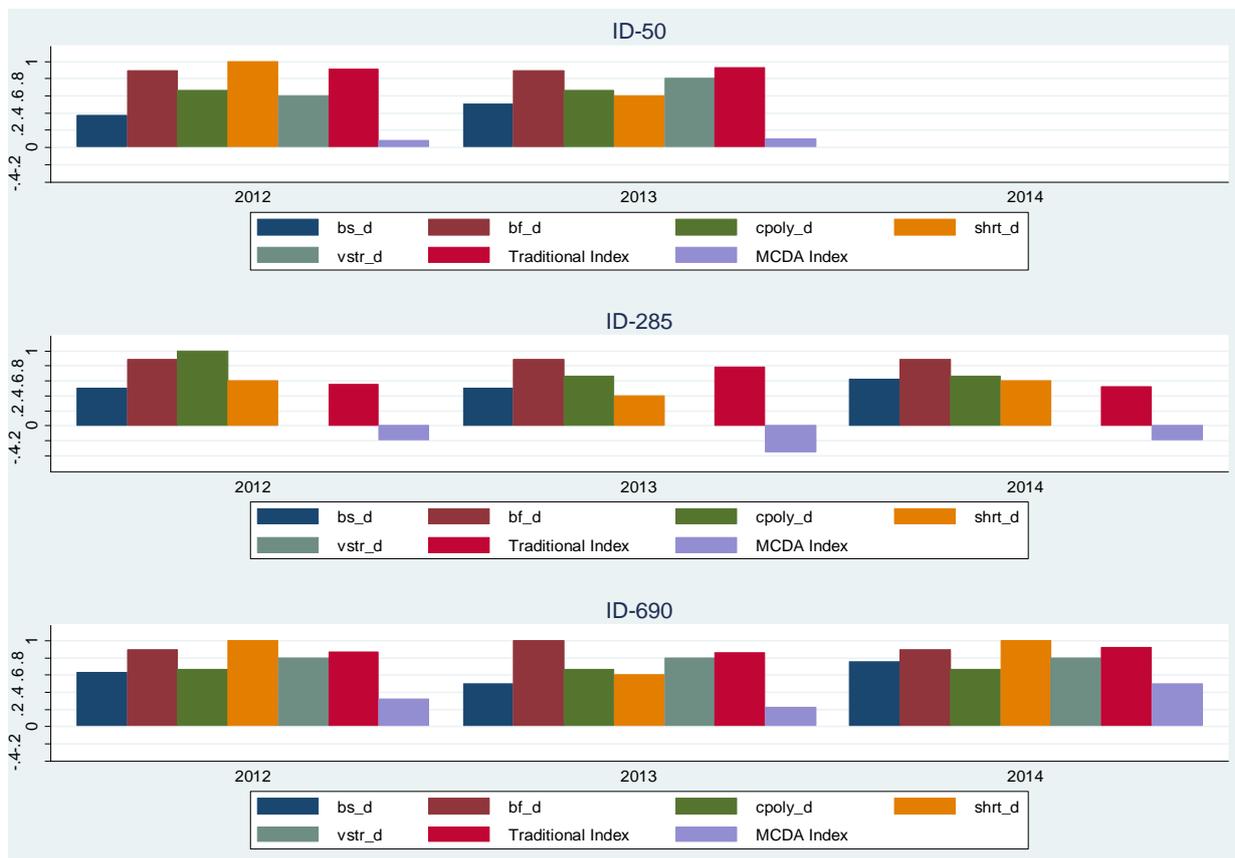
Figure 4. Corporate governance perspectives, traditional index, and MCDA index for three companies in the energy industry (y-axis is corporate governance score; no data reported for ID-50 in 2014).

Given these preliminary visual aids through the outranking analysis, this new MCDA-based approach penalizes those firms with problems to report or comply with the corporate governance practices and mechanisms; an approach relying on the dominance relationships among firms relative to their peers.

The correlation matrix reveals that *ngvi* is significantly and positively associated with *cgvi_d* (54.4%), and *aqcg_d* (54.5%). The correlation between *aqcg_d* and *cgvi_d* is even higher (76.6%). Although these figures may suggest similarities among the corporate governance quality measures, our objectives in the second stage based on the panel data analysis are to examine whether a) the effect of the proposed index on firm performance leads to different findings; and b) the new index provides a better explanatory power and statistical significance regarding its relationship with firm performance.[7]

3.6. Firm performance and corporate governance in the extant literature

Some scholars used aggregate measures of corporate governance (i.e., indices or ratings) (Alimehmeti & Paletta, 2014; Bebchuk et al., 2006; Bhagat et al., 2008; Brown & Caylor, 2006; Ertugrul & Hegde, 2009; Gompers et al., 2003; Vander Bauwhede & Willekens, 2008). Others relied on specific corporate governance practices or mechanisms (e.g., board structure, ownership, board function, duality) (Bhagat & Bolton, 2008; Brown & Caylor, 2006; Brown et al., 2011; Krause et al., 2014; Wang et al., 2012; Wintoki et al., 2012) to analyse firm outcomes (e.g., operational performance, sales, efficiency, returns, valuations, and risk). Table 4 presents the use of ROA (earnings before interest, taxes, depreciation and amortization over total assets) in corporate governance studies. It clearly shows the lack of consensus in the literature regarding the effect of various corporate governance indices on performance.

[INSERT TABLE 4 HERE]

Although the MCDA approach can be implemented either on proprietary or on academics indices, we use the corporate governance index (ASSET4 ESG) from Datastream, which has not been used in any of the papers, and the crisis period (2007-2008) as well as the post-crisis period has not been studied. The main aim is to provide both a fresh perspective using a new proprietary index and their influence on ROA, as a common company performance metric across the literature in corporate governance, based on a large panel set using recent data, especially during and after the crisis period.

It is argued that (see e.g., Chan et al., 2017; Chaudhuri et al., 2016, Pastor et al., 2006; Xidonas et al., 2009; Zervopoulos et al., 2016) relying on a single indicator as a proxy for company performance tends not to be a good practice. Some indicators focus on the efficiency of reducing operating costs and others reveal the

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[7] To conserve space, we do not report the correlation matrix but it is available on request. We use pairwise correlations with Bonferroni-adjusted significance levels. The variance inflation factors (VIFs) are far less than 10 with the mean value of 2.24, indicating the absence of the multicollinearity problem.

effective use of assets or equity in generating income. Therefore, we employ five additional performance measures to provide a more complete picture regarding the link between performance and corporate governance. Following especially the operations management and operations research literature, for example, Chan et al. (2017), Chaudhuri et al. (2016) and Consiglio and Zenios (1999), our additional measures are Net Income (*netincroa*), EBIT (*ebitroa*), ROIC as return on invested capital (*roic*), ROE (*nroe*) and Sales Growth (*salesgrowth*). The definitions are available in Table A1.

3.7. Company-specific characteristics

Following the literature, for our main regression analyses, we use size, age, number of business segments, growth opportunities, leverage, and stock price volatility described as below (see Table A1). Table 3 shows summary statistics for corporate governance (panel A), and performance and other firm-specific factors (panel B) across years. Panel B Table 3 reveals that ROA takes values between 10%-15% during 2002-2014. The statistics for the other variables are comparable to the empirical literature. The variables are explained as follows: i) Size (*lmv*): Daines et al. (2010); Renders et al. (2010) and Wintoki et al. (2012) employ market value of equity (*mv*) in its logarithm form as a proxy for firm size; ii) Age (*age2fndinc)*: Brown & Caylor (2006), Chok and Sun (2007), Chambers and Dimson (2009), Renders et al. (2010) and Wintoki et al. (2012) use the natural log of the company's age to control the estimations (*lage2fndinc*) due to the concerns related to the symmetrical distribution, outliers and normality in estimations; iii) Number of business segments (*busegm*): This variable is considered in Wintoki et al. (2012), proxied by the logarithm of the number of business segments (*lbusegm*); iv) Growth opportunities: market-to-book ratio (*mtb2*). Other studies use this variables as a firm performance as it is associated with Tobin's Q despite their limitations (e.g., Gugler et al., 2004). However, Lehn et al. (2009), Linck et al. (2008) and Wintoki et al. (2012) provide empirical evidence that growth options are a cause, rather than an effect, in corporate governance structure[8]; v) Debt (*ltdebtasset*): Long-term debt to total assets to represent financing structure (Alimehmeti & Paletta, 2014; Brown et al., 2011; and Wintoki et al., 2012); vi) Stock price volatility (*nvolreturn*), it is the standard deviation of the company's

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[8] The corporate finance literature (e.g., Hutchinson and Gul, 2004) states that growth options determine financial performance due to the issues related to agency conflicts, asymmetric information and control mechanisms. For instance, corporate performance would decrease if growth firms face underinvestment or overinvestment inefficiencies. Similarly, the resource-based view contends that firms with good growth opportunities are likely to yield superior financial performance (see e.g., Barney, 1991). As an additional check, we followed the procedure proposed by Dumitrescu and Hurlin (2012) to test for the Granger causality in panel datasets; i.e., whether growth options influences financial performance or vice-versa. As our *p*-value strongly rejects the null hypothesis that growth opportunities do not Granger-cause firm performance as opposed to the hypothesis that they do, one can deduce from this test that the causality is likely to run from growth options to performance.

monthly return index over the past 12 months. It controls for the company's risk level (Bhagat & Bolton, 2008; Bhagat et al., 2008; Wintoki et al., 2012).

3.8. Models

The main rational followed by the proposed MCDA approach is to evaluate whether the dominance relationships among peer companies, in terms of corporate governance practices and mechanisms, increase the statistical significance and explanatory power in contrast to a traditional corporate governance index. Our approach should address the following concerns: 1) heterogeneity among companies, industries, and corporate governance mechanisms raised by, e.g., Mehran et al. (2011), and 2) stickiness within the most corporate governance criteria remains unchanged for long periods of time (Brown et al., 2011; Schnyder, 2012). Thus, our MCDA perspective detects even small changes among companies and homogenises the industry and firm differences in terms of net flows (credits and debits among companies). As a result, the approach yields stronger and more reliable estimations for the regression models adopted by the literature for corporate governance studies (see e.g., Brown et al., 2011; Cremers & Ferrell, 2014; Daines et al., 2010; Wintoki et al., 2012; and Yermack, 1996). The models for panel data analysis can be shown as follows (*i,* firms; *t,* time):

$$roa_{it} = \beta_0 + \beta_1 CGIndex_{it} + \sum_{k=1} \gamma_k\ Controls_{it} + \varpi_i + \varpi_t + \eta_{it} \qquad (5)$$

where *roa* is the ratio of EBITDA (earnings before interest, taxes, depreciation and amortization) to total assets; *CGIndex* is either *ncgvi* or *aqcg_d*; *ncgvi* is the traditional corporate governance metric provided by Datastream, *aqcg_d* is our new metric for the aggregate quality of corporate governance based on the MCDA approach; β_0 is the constant term; β_1 is our coefficient of interest; and γs are estimable slope terms; ϖ_i represents unobserved and time-invariant firms' fixed effects including the industry group they operate in; ϖ_t is for time-specific effects that potentially influence all firms; η_{it} is the time-varying error term that is serially uncorrelated with mean zero and variance. *Controls* are as explained in section 3.4. The model uses year dummies as controls.

4. Results

4.1. Univariate analysis

Using pair comparisons among companies and an aggregate quality of governance based on net flows that synthesise companies' differences and outranking perspectives, it is possible to evaluate whether by this approach these heterogeneities could be mitigated. Thus, our data set is divided into two panels (non-financial and financial sector) as suggested by Mehran et al. (2011), and the univariate analyses are implemented (*t*-test

and Wilcoxon test of difference in means and medians, respectively) in order to test the differences for firm performance, corporate governance measurements, and control variables.

Table 5 shows that the mean and median differences between the performance of firms in non-financial and financial sectors are statistically significant at the 1% level (Panel A) as well as for the traditional corporate governance index (Panel B), growth opportunities, volatility, firm age, capital structure and ownership structure (Panel C). Note that the differences associated with the aggregate quality of corporate governance (*aqcg_d*) using the MCDA approach is significant at the 10% level for the mean, which is aligned with Mehran et al. (2011) who find that these two sectors are different regarding corporate governance practices.

[INSERT TABLE 5 HERE]

4.2. Regression analyses

Table 6 reports first the fixed effects regression results (models 1 and 2).[9] To complement these main results, we also use panel-corrected standard error (PCSE) estimates (Greene, 2018), which assumes that the errors are heteroskedastic and contemporaneously correlated across panels (models 3 and 4). The results for both methods show a clear dominance of our measure (*aqcg_d*) that is statistically significant at the 1% level, in contrast to the traditional measure (*ncgvi*) which exerts no significant influence on firm performance.

The negative sign of *aqcg_d* is aligned with some other corporate governance studies using traditional corporate governance indices (Bhagat et al., 2008; Daines et al., 2010; Ertugrul & Hegde, 2009). Indeed, our results reveal that the higher the firm's *aqcg_d*, which represents a stronger dominance and outranking relationships among their peers on corporate governance practices, the lower its performance. The possible reason for this negative association may stem from the fact that firms allocate significant amount of time and resources in order to comply with good corporate governance practices.

[INSERT TABLE 6 HERE]

We provide additional robustness analyses considering other proxies for performance based on the accounting and financial statements. Our main findings (untabulated but available on request) are again, except in one case, confirmed with very consistent regression results across alternative proxies and estimation methods.[10]

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[9] In unreported results, the *p*-value (<0.01) for the Breusch-Pagan LM test confirms the presence of panel effects and the *p*-value (<0.01) for the Hausman test favours fixed effects over random effects estimations.

[10] These additional variables for performance are labelled as *netincroa,* ebitroa, *roic*, nroe and *salesgrowth;* they are defined in the Appendix. It appears that the effect of ROE on corporate governance quality is positive and significant for both quality constructs. The reason for this finding is that ROE is not an overall performance measure and may not explain enough about the multi-dimensional

5. Further considerations

Although our key results (models 1 to 4) in Table 6 are highly consistent, we investigate whether our findings are sensitive to other considerations. Firstly, following Larcker et al. (2007) and Renders et al. (2010), we introduce some sub-sampling analyses (i.e., financial vs. non-financial firms and the latest financial crisis period (2007-2008)). Table 6 shows that the coefficient estimate on our corporate governance metrics is still negative and significant at the 1% level for both sectors (models 5 to 8), and during the latest global financial crisis period whereas the traditional measure is related to firm performance either insignificantly or weakly across these sub-samples (models 9 and 10).

Secondly, we argue that stickiness is the major limitation on corporate governance studies and the traditional aggregate measurements fail to provide enough evidence about dominance relationships in terms of corporate governance practices and mechanisms among companies. Consequently, we also consider other adjustments as discussed in Core et al. (2006) and Ertugrul & Hegde (2009). These papers use future operating performance regressed on current corporate governance information and control variables to avoid two issues: *i*) to evaluate whether endogeneity (i.e., corporate governance might affect performance or vice-versa) can be a limitation; *ii*) to avoid look-forward bias (incorrect assumption that performance is immediately affected by the instantaneous release of governance information at the end of the fiscal year). This non-contemporaneous approach is also used by Bhagat et al. (2008) mainly to evaluate whether corporate governance indices predict future performance. Considering this issue, Table 7 employs future performance (both ROA_{t+1} and ROA_{t+2}), and future performance as the average of ROA_{t+1} and ROA_{t+2}, regress them on contemporaneous corporate governance measurements and other firm-specific factors. The results reveal again that our main findings remain to be valid. Once more, for all the specifications, our measure *aqcg_d* affects future company performance significantly with a negative link whereas the traditional measure *ncgvi* has no significant association with future ROA. These findings may shed some light on the conflicting evidence in the literature as summarized in Table 4.

[INSERT TABLE 7 HERE]

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aspects. In fact, ROE is the outcome of the interaction between efficiency and financial indebtedness of the firms and its focus is on shareholders' rate of return. Hence it would not be straightforward to figure out whether a change in performance is attributed to change in operational efficiency or in capital structure or even pay-out policy, noting that repurchasing shares mechanistically improves ROE. Chaudhuri et al. (2016) too refer to ROE as a problematic performance measure, and we recommend a further research of its usage as key performance proxy. Moreover, these additional estimates reveal that the impact of the traditional governance index on firm performance is quite sensitive to the definition of the latter.

Thirdly, the literature refers to the endogenous association between performance and capital structure and shows that corporate leverage is endogenously determined (see e.g., Firth et al., 2008; Margaritis & Psillaki, 2010). We resort to the two-stage instrumental variable (IV) method to address this issue: in stage one, debt ratio is regressed on its potential determinants and in stage two we use the fitted values of leverage in the performance models.[11] We report the results in Table 8 (models 5 and 6): both corporate governance measures yield strongly significant and negative coefficients but it is important to note that this set of results again confirms the consistent 'negative' finding based on our construct.[12]

Fourthly, the literature also acknowledges that corporate ownership can influence financial performance (see e.g., Chaganti & Damanpour, 1991; Demsetz & Villalonga, 2001). To control for the effects of ownership structure when examining the link between corporate governance and performance, we use three variables by considering the aspects of insider ownership (*insider*), institutional ownership (*institution*) and ownership concentration (*concentration*) and report the results in all models in table 8.

The other robustness checks include; *i*) using sales revenues to measure firm size (*lsale* in all models) and *ii*) considering a parabolic link between firm age and firm performance (using *lage2fndinc* and *l2age2fndinc* in all models). These additional checks as well confirm our main findings and reveal that our corporate governance measure continues to yield consistently negative and significant (at the 1% level) results whereas we observe inconsistent findings with respect to the traditional corporate governance measure.

The objective of this paper is to examine the effect of corporate governance on financial performance. Nevertheless, we also examined the link between corporate governance quality and corporate value creation measured by Tobin's Q. The results are reported in models 7-10 of table 8: in terms of the statistical significance of the coefficients, our construct is again consistent with the 1% significance level, unlike the traditional governance measure. However, the signs pertaining to both governance measures are positive. The positive association between Tobin's Q and value creation is in line with the extant literature as established evidence (see e.g., Singh et al., 2018; Klapper and Love, 2004; Bae et al., 2012). This suggests that improved

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[11] We use the Durbin-Wu-Hausman (DWH) test to examine the presence of endogeneity. Our significant *p*-value rejects the null hypothesis of the exogeneity of the regressor. In this two-stage estimation setting, we use firm size and growth options as the external exogenous leverage determinants in the first stage. Our results are insensitive to choosing lagged values of leverage as internal instruments. The validity of the instruments has been confirmed by the Sargan test.

[12] Wintoki et al. (2012), among others, suggest the use of lagging all explanatory variables for partial control of the endogeneity concerns. Following this suggestion, we regress the current firm performance (ROA_t) on all explanatory variables lagged by one period. In untabulated results, we again notice that our main results are qualitatively the same.

corporate governance practices are associated with higher market value but lower accounting performance. Given the focus of our study, future studies may investigate thoroughly the underlying factors and channels behind these contradictory findings using the proposed MCDA approach.

[INSERT TABLE 8 HERE]

6. Conclusion

This study introduces a novel perspective, using MCDA based on outranking analysis, to evaluate corporate governance heterogeneities and internal practices and mechanisms to see how they are addressed and controlled. Furthermore, computing a new aggregate quality of corporate governance based on the same information used for the traditional corporate governance index construction but by employing an exhaustive set of pair comparisons and outranking analysis provides robustness in the empirical results. We used pooled OLS, IV, fixed and random effects methods with robust standard errors.

We used a set of five commonly used performance variables to test the robustness of the proposed approach. We also conducted regressions for different sampling framework and addressed the endogeneity concerns, noting that our novel corporate governance measure is less susceptible to endogeneity relative to its existing alternatives. These analyses suggest that our proposed measure for corporate governance quality is very significantly and negatively associated with firm performance but this relationship is very weak or non-existent when the traditional measured is opted for. One may attribute the costs related to following various 'good' corporate governance practices to this negative link between corporate governance quality and financial performance. Namely, there are various direct costs of maintaining good corporate governance, (i.e., board function, board structure, compensation policy, shareholders rights and vision and strategy) but the underlying benefits may not be as tangible as company managers would expect.

The proposed MCDA approach, based on the PROMETHEE methods, reveals a new and fundamental path to analyse the link between corporate governance and firm performance. Moreover, it overcomes the limitations of traditional governance indices that are associated with various problems such as weighting and stickiness. Traditional measurements thus fail to detect and scrutinize small differences among companies regarding their governance quality. Therefore, our approach can be used by policymakers, investors, managers, shareholders, and stakeholder to evaluate the stability and explanatory power of other existing indices to understand how corporate governance mechanisms influence firm performance. This paper does not intend to compromise the

current practices of selecting companies for investments. Rather, our main goal is to contribute to the current literature of corporate financial decision making and to extend the MCDA based on the multidimensional perspectives of corporate governance information.

Surely, our analysis itself is subject to some limitations: i) the corporate governance adjustments and transformations implemented may be examined by external parties (i.e., investors, regulators, and other stakeholders). Therefore, other academics and proprietary indices need to be assessed by paying careful attention to corporate governance indicators, perspectives, criteria for normalisation, information overlapping, among other aspects; and ii) the comparisons among companies to get the aggregate quality of corporate governance is developed across industries; however, other circumstances (i.e., law and regulations), relative weights of preferences over the criteria selected, other preferences functions to model additional preferences and indifference values into the PROMETHEE methods, sensitivity analysis on criteria weights that requires running numerous regression models or implementing fuzzy regression methods (see e.g., Ramli et al., 2011; Wang &Tsaur, 2000), among other robustness and simulation analyses (Simon et al., 2013), are out of the scope of our paper. Future research is warranted on mitigating such limitations.

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APPENDIX

Table A1. The definition of variables.

Variable	Definitions and Datastream codes
Dependent variables	*Company performance:*
roa	Earnings before interest, taxes, depreciation and amortization–EBITDA (WC18198) to book value of total assets (WC02999).
netincroa	Net income before extraordinary items and preferred dividends (WC01551) to book value of total assets (WC02999).
ebitroa	Earnings before interest and taxes, EBIT (WC18191) to book value of total assets (WC02999).
roic	Return on invested capital (WC08376), which is net income plus (interest expense-interest capitalized)*(1-tax rate), all scaled by average total capital including short-term debt.
nroe	Return on equity (WC08301), which is net income before extraordinary items and preferred dividends divided by total equity.
salesgrowth	Annual percentage change in the growth of net sales or revenues (WC01001).
Explanatory variables	*Corporate governance:*
ncgvi	Corporate governance index (CGI) provided by Datastream (ASSET4 ESG). This is a proprietary index measuring firms' exposure and reports to the corporate governance practices and mechanisms. CGI is in decimal values and computed using weighted z-scores adjusted by some "black box" reference values.
aqcg_d	Aggregate quality of corporate governance using the MCDA approach, It is an indicator of dominance relationships and quality of governance among companies, which is obtained through an extensive process of pair comparisons.
Control variables	*Company-specific information:*
lmv	The logarithm of the market value of the company (MV). This information is adjusted by calendar year.
lsale	The logarithm of the total sales adjusted for inflation.
mtb2	Market-to-book ratio: (Market value of equity (MV, adjusted for the fiscal year-end) + Total assets - Common equity (WC03501) - Deferred taxes (WC03263)) / Total assets.
ltdebtasset	Ratio of long term debt (WC03251) to total assets.
lbusegm	Logarithm of the number of a company's business segments. Thomson One Banker is considered in order to count business segments reported by each company at the end of the fiscal year. The data vendor reports eight business segments.
lage2fndinc	The logarithm of age of the company. It is constructed also using Thomson One Banker, namely, when the company was founded (TF.FN.CompanyFoundedDate) and/or when it was incorporated (TF.FN.CompanyIncorporatedDate) until 31/12/2014. If a company shows both information, the age used is the company foundation, otherwise, only the information of incorporation.
nvolreturn	It corresponds to the past-twelve months of volatility of the returns. It is computed using the standard deviation of the return index (RI). RI is available for individual equities and unit trusts and assumes that dividends are re-invested to purchase additional units of an equity or unit trust at the closing price applicable on the ex-dividend date.
insider	The number of shares held by insiders such as corporate directors and officers divided by total shares.
institution	The number of shares held by institutional investors divided by total shares.
concentration	The fraction of shares held by the three largest shareholders.

Table 1. Sample size and industrial classification.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	Total
2002	27	64	72	26	73	41	51	61	10	26	**451**
2003	27	64	72	26	74	41	51	61	10	26	**452**
2004	36	88	83	48	116	60	70	82	13	36	**632**
2005	43	105	95	50	129	61	78	91	14	38	**704**
2006	41	110	95	51	127	59	79	90	15	38	**705**
2007	42	108	100	58	126	58	84	87	12	40	**715**
2008	49	134	118	73	172	70	121	100	16	52	**905**
2009	62	149	121	79	189	83	143	121	17	59	**1,023**
2010	65	163	118	80	196	83	149	130	17	57	**1,058**
2011	63	164	115	78	193	79	148	130	16	51	**1,037**
2012	62	162	113	77	191	75	144	127	15	50	**1,016**
2013	53	139	93	65	170	60	122	103	9	36	**850**
2014	33	109	64	56	122	40	92	86	6	15	**623**
Total	*603*	*1,559*	*1,259*	*767*	*1,878*	*810*	*1,332*	*1,269*	*170*	*524*	*10,171*
%	*5.93*	*15.33*	*12.38*	*7.54*	*18.46*	*7.96*	*13.10*	*12.48*	*1.67*	*5.15*	*100.00*

Notes: (1): Basic materials, (2): Consumer cyclicals, (3): Consumer non-cyclicals, (4): Energy, (5): Financials, (6): Healthcare, (7): Industrials, (8): Technology, (9): Telecommunications services, (10):Utilities

Table 2. Corporate governance perspectives, definitions, categories and data adjustments.

A. Board Structure: *It represents how well-balanced is the board of directors to have an independent decision-making process (experienced, diverse and autonomous).*		
1.	**Board structure/ policy:** It considers whether a company has a policy for keeping a harmonious board membership.	Yes =1; No = 0.
2.	**Experience:** Average number of years each board member has been on the board.	If the firm average ≥ industry average =1; 0, otherwise.
3.	**Percentage of non-executive board members** in the board	If the firm average ≥ industry average =1; 0, otherwise.
4.	**Percentage of independent board members**.	If the firm average ≥ industry average =1; 0, otherwise.
5.	**CEO-Chairman structure:** Is there a CEO-Chairman separation? AND has the Chairman been the CEO of the firm? The transformation reflects some concerns form Krause et al. (2014) that duality deteriorates corporate governance practices	No &No=1, No &Yes or Yes &No =0.5, Yes &Yes=0.
6.	**Background and skills:** Does a company describe the professional experience or skills of every board member? OR Does the company provide information about the age of individual board members?	Yes =1; No = 0.
7.	**Size of board:** The overall number of board participants reported at the end of the fiscal year. The transformation reflects some concerns from Boone et al. (2007) who indicate that as companies grow, boards grow so there is no optimal size, and Coles et al. (2008) who argue that one size does not fit all. Hence, we introduce a fuzzy adjustment around the average industry.	If the values are around +/-10% industry average =1; 0, otherwise.
8.	**Board diversity:** Percentage of women on the board of directors.	If the firm average ≥ industry average =1; 0, otherwise.
B. Board function: *It measures the board activities and functions related to management alignment, commitment and effectiveness according to the corporate governance principles; and the role of board committees based on the given responsibilities.*		
9.	**Audit committee independence:** Percentage of independent board members on the audit committee as stipulated by the company.	If the firm average ≥ industry average =1; 0, otherwise.
10.	**Audit committee management independence:** It examines the non-executive members affiliated on the audit committee according to the firm's requirements (in percentage).	If the firm average ≥ industry average =1; 0, otherwise.
11.	**Audit committee expertise:** Does the company have an audit committee with at least three members and at least one "financial expert" as per Sarbanes-Oxley Act?	Yes =1; No = 0.
12.	**Compensation committee independence:** Percentage of independent board members on the compensation committee as stipulated by the company.	If the firm average ≥ industry average =1; 0, otherwise.
13.	**Compensation committee management independence:** It considers the non-executive board members (in percentage) on the compensation committee according to the company's stipulations.	If the firm average ≥ industry average =1; 0, otherwise.
14.	**Nomination committee independence:** Percentage of non-executive board members on the nomination committee.	If the firm average ≥ industry average =1; 0, otherwise.
15.	**Nomination committee management independence:** It considers the non-executive board participants on the nomination committee (in percentage) based on the firm' stipulations.	If the firm average ≥ industry average =1; 0, otherwise.
16.	**Number of board meetings** including all special meetings (during the fiscal year). The rational for this consideration is that the higher the number of meetings the better the company monitoring	If the firm average ≥ industry average =1; 0, otherwise.
17.	**Board meeting attendance average**: It considers the average of attendance in the board meetings according to the company's reports. Same adjustment to (16)	If the firm average ≥ industry average =1; 0, otherwise.
C. Compensation policy: *it measures the corporate governance practices regarding competitive and balanced management compensation not only to attract and retain executives and board members but also to link their compensation to individual or company targets.*		
18.	**Compensation policy:** Reveals whether the company has a policy of performance-oriented compensation in order to appeal and maintain the board members and senior managers or executives.	Yes =1; No = 0.
19.	**Highest remuneration package:** The highest value within the company in USD. For data transformation, reporting is a good practice for this criterion (OECD, 2004). Does the company report this information?	Yes =1; No = 0.
20.	**Total board member compensation** of the non-executive board members in USD. For data transformation, reporting is a good practice for this criterion (OECD, 2004). Does the company report this information?	Yes =1; No = 0.
21.	**Stock option program:** Does the company status or by-laws require that stock-options are only granted with a vote at a shareholder meeting?	Yes =1; No = 0.
22.	**Senior executive long-term compensation incentives:** Does the company report the time horizon (maximum) of the targets to achieve full senior executives' compensation?	Yes =1; No = 0.
23.	**Vesting of Stock Options/Restricted Stock:** Since the date of the grant, does the company report the number of years of the most recent granted (or restricted stock options) taken to fully vest?	Yes =1; No = 0.
D. Shareholder Rights: *it considers the best practices in corporate governance for equal treatment of shareholders (large and minority), and limiting the use of anti-takeover devices.*		
24.	**Shareholder rights/ policy**: Does the company have a policy to treat equally the minority shareholders, facilitate shareholder engagement or limit the usage of anti-takeover devices?	Yes =1; No = 0.
25.	**Voting rights:** It specifies whether all the company's shares offer equally voting rights	Yes =1; No = 0.

Table 2 (continued)

26.	**Ownership**: It verifies whether a shareholder, with the largest voting rights, veto power or golden share, owns the company.	Yes =0; No = 1.
27.	**Classified board structure:** It checks whether the company has a classified board structure. The rational for the values transformation comes from Bhagat & Bolton (2008) who mention that devices such as poison pills, golden parachutes, classified boards undermine boards' and companies' flexibility.	Yes =0; No = 1.
28.	**Staggered board structure**: Does the company have a staggered board structure? Regarding the data transformation, staggered boards can allow managers to extract rents from shareholders (i.e., Bebchuk and Cohen (2005) cited by Larcker et al. (2011)), which is not considered as a good corporate governance practice.	Yes =0; No = 1.
E.	**Vision and strategy:** *it measures management commitment and effectiveness to integrate financial and non-financial aspects (i.e., social and environmental) into the daily operations.*	
29.	**Integrated vision and strategy challenges and opportunities:** Does the company openly report information about the opportunities and difficulties related to the financial and non-financial integration?	Yes =1; No = 0.
30.	**CSR sustainability committee:** It reveals whether the firm has a committee of corporate social responsibility.	Yes =1; No = 0.
31.	**Global Reporting Initiative (GRI) guidelines:** Does the published corporate social responsibility report of the firms follow the GRI guidelines?	Yes =1; No = 0.
32.	**CSR sustainability report global activities**: Does the company's non-financial report consider its global activities?	Yes =1; No = 0.
33.	**CSR sustainability external audit:** Does the company have an external auditor of its CSR/Health & Safety/Sustainability report?	Yes =1; No = 0.

Notes: If companies do not disclose about audit committee independence, figures are calculated using the equation (#Independent Board Members) / (#Audit Committee Members + #Independent Board Members). If companies do not disclose about compensation committee independence, figures are calculated by (#compensation committee members who are independent/#compensation committee members). The data point about compensation committee management independence is shown when companies publish an overall statement on the non-executives of the audit committee. If the information about nomination committee independence is disclosed then this figure will be shown; otherwise, it will be calculated by (#nomination committee members who are independent/#nomination committee members). The data point about nomination committee management independence is answered when the company publishes an overall statement on the non-executives of the audit committee. For the voting rights, companies that do not have dual class stock, non-voting shares, multiple or double voting rights shares, priority shares or transfer limitations, voting cap or minimum number of shares to vote, will be assigned a "Yes". All classified boards are staggered but all staggered boards are not in fact classified boards. For the CSR sustainability external audit, there is a statement from an external auditor on the CSR / H&S / Sustainability report, with or without indication that the data in the report has been checked (Thomson Reuters). All the data adjustments (nominal to numeric) are introduced by the authors of this paper according to the best practices of corporate governance.

The reference values used for some numerical transformations consider a simple approach based on industry averages. Yet, the approach allows to use other preferences and indifference values (i.e., median and mode), or continuous specifications to normalise specific criteria according to their gradients. These adjustments need to be supported either by the literature or by users of corporate governance information.

Table 3. Summary statistics.

Panel A. Corporate governance criteria

		2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
ncgvi	mean	0.659	0.683	0.733	0.741	0.747	0.736	0.741	0.710	0.731	0.722	0.724	0.775	0.700
	sd	0.228	0.214	0.167	0.159	0.156	0.146	0.161	0.178	0.163	0.166	0.164	0.145	0.172
cgvi_d	mean	2.296	2.514	2.593	2.714	2.876	3.051	3.131	3.207	3.277	3.349	3.360	3.113	3.218
	sd	0.406	0.392	0.367	0.390	0.382	0.385	0.434	0.479	0.491	0.502	0.504	0.470	0.516
bs_d	mean	0.506	0.550	0.561	0.594	0.596	0.597	0.600	0.606	0.606	0.611	0.615	0.613	0.572
	sd	0.164	0.162	0.155	0.156	0.159	0.158	0.156	0.162	0.164	0.163	0.162	0.160	0.147
bf_d	mean	0.589	0.730	0.776	0.785	0.802	0.828	0.825	0.823	0.822	0.826	0.828	0.831	0.715
	sd	0.205	0.172	0.149	0.125	0.128	0.092	0.093	0.105	0.105	0.099	0.097	0.092	0.166
cpoly_d	mean	0.385	0.400	0.416	0.474	0.573	0.654	0.700	0.732	0.766	0.795	0.821	0.818	0.813
	sd	0.135	0.141	0.158	0.161	0.166	0.160	0.169	0.185	0.189	0.185	0.184	0.185	0.189
shrt_d	mean	0.776	0.786	0.799	0.810	0.843	0.851	0.855	0.854	0.858	0.864	0.815	0.577	0.873
	sd	0.195	0.191	0.180	0.177	0.153	0.141	0.144	0.145	0.145	0.143	0.177	0.138	0.151
vstr_d	mean	0.040	0.048	0.041	0.051	0.062	0.120	0.151	0.192	0.225	0.253	0.281	0.275	0.246
	sd	0.112	0.126	0.113	0.137	0.145	0.214	0.252	0.278	0.294	0.308	0.321	0.323	0.318
aqcg_d	mean	-0.432	-0.715	0.045	0.095	-0.146	-0.029	-0.079	-0.235	0.348	0.152	0.232	0.110	-0.106
	sd	0.256	0.256	0.241	0.262	0.253	0.259	0.272	0.284	0.280	0.288	0.278	0.255	0.278

Panel B. Company performance and other firm characteristics

		2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
roa	mean	0.104	0.115	0.130	0.135	0.146	0.139	0.109	0.106	0.128	0.130	0.120	0.122	0.120
	sd	0.182	0.112	0.107	0.124	0.123	0.123	0.173	0.152	0.113	0.118	0.137	0.105	0.144
netincroa	mean	0.013	0.035	0.052	0.055	0.063	0.057	0.026	0.031	0.053	0.055	0.045	0.050	0.049
	sd	0.208	0.101	0.084	0.096	0.098	0.091	0.150	0.136	0.085	0.086	0.114	0.085	0.116
ebitroa	mean	0.058	0.074	0.091	0.097	0.108	0.101	0.068	0.066	0.089	0.093	0.082	0.084	0.082
	sd	0.190	0.108	0.100	0.117	0.120	0.115	0.170	0.149	0.105	0.111	0.136	0.103	0.145
roic	mean	0.060	0.075	0.106	0.112	0.127	0.121	0.073	0.076	0.102	0.109	0.095	0.098	0.095
	sd	0.342	0.212	0.181	0.236	0.189	0.178	0.212	0.221	0.162	0.153	0.151	0.130	0.132
nroe	mean	0.009	0.229	0.121	0.169	0.204	0.229	0.127	0.070	0.142	0.245	0.089	0.271	0.150
	sd	1.364	3.813	1.253	1.700	0.769	2.063	1.377	0.973	0.371	3.097	1.426	3.406	0.920
salesgrowth	mean	-	0.129	0.160	0.168	0.152	0.123	0.082	-0.065	0.101	0.112	0.052	0.035	0.050
	sd	-	0.275	0.259	0.361	0.271	0.225	0.283	0.355	0.317	0.244	0.181	0.169	0.197
mv	mean	7,898	10,279	11,423	12,182	13,447	15,278	10,874	10,684	11,902	11,653	14,242	16,212	18,084
	sd	21,699	27,062	28,398	27,872	30,440	34,097	25,844	23,754	25,386	26,021	34,361	33,598	38,629
lsale	mean	14.460	14.563	14.670	14.823	14.969	15.036	15.091	15.005	15.101	15.233	15.287	15.331	15.396
	sd	1.668	1.622	1.651	1.574	1.473	1.494	1.522	1.445	1.400	1.364	1.343	1.338	1.323
mtb2	mean	1.664	1.943	1.998	2.130	2.051	2.235	1.713	1.683	1.785	1.683	1.796	1.988	2.029
	sd	1.223	1.310	1.342	2.681	1.305	1.665	1.099	1.033	1.194	1.091	1.168	1.337	1.325
busegm	mean	4.09	4.08	4.07	4.05	4.04	4.02	4.01	4.00	3.99	3.99	3.98	3.98	3.98
	sd	2.08	2.07	2.07	2.06	2.05	2.06	2.05	2.04	2.04	2.03	2.03	2.03	2.03
age2fndinc	mean	35.47	36.16	36.54	36.97	37.25	37.90	38.60	39.19	39.74	40.69	41.75	42.72	43.85
	sd	30.09	30.15	30.28	30.41	30.41	30.58	30.69	30.76	30.88	31.03	31.13	31.14	31.18
ltdebtasset	mean	0.224	0.215	0.207	0.199	0.212	0.225	0.240	0.227	0.218	0.229	0.242	0.247	0.256
	sd	0.212	0.184	0.186	0.182	0.271	0.260	0.219	0.198	0.193	0.200	0.219	0.217	0.202
nvolreturn	mean	0.120	0.095	0.077	0.074	0.072	0.073	0.136	0.144	0.089	0.085	0.079	0.064	0.058
	sd	0.080	0.064	0.049	0.036	0.036	0.036	0.072	0.128	0.050	0.052	0.288	0.069	0.046
insider	mean	5.374	4.930	4.964	4.761	4.254	3.980	3.923	3.577	3.175	2.872	2.959	2.767	2.472
	sd	12.471	11.128	10.819	10.750	9.536	9.078	9.361	8.364	7.567	6.789	7.308	7.075	6.199
institution	mean	73.553	76.088	78.505	79.139	80.838	81.978	80.945	82.878	83.479	83.465	84.089	86.561	87.352
	sd	19.581	18.303	18.188	17.912	16.918	18.130	20.862	18.167	16.621	17.607	16.276	16.163	16.357
concentration	mean	23.191	22.820	23.302	23.368	24.287	24.463	24.373	24.122	23.502	22.919	22.405	22.085	22.530
	sd	16.568	17.102	15.919	16.509	15.652	15.875	15.934	15.356	14.206	13.932	13.65	12.622	10.907

Notes: See Table 2 for the construction of the corporate governance criteria and Table A1 for the definition of the variables.

Table 4. Company performance (ROA) and corporate governance: a summary of the empirical literature.

Paper	Sample/Period	Corporate governance information	Methodology	Relationship
Wintoki et al. (2012)	U.S. listed firms: 6,000 (20,000 firm-years); 7 two-years interval (1991-2003)	Board size, independence, duality (Compustat, CRSP)	Pooled OLS, Fixed Effects, and GMM	Negative or none
Daines et al. (2010)	U.S. listed firms: 5,059 for CGQ, 1,565 for GMI, 1,906 TCL, and 6,714 for AGR; period 2005-2007	Corporate governance ratings: ISS (CGQ) , GIM, TLC, AGR (Audit Integrity's Accounting Governance and Risk)	Pooled OLS	Weak
Renders et al. (2010)	Two samples of EU countries (1,199 firm-years for FTSEurofirst 300); period 1999-2003	Deminor rating on corporate governance	Pooled OLS, 2SLS	Negative and positive
Ertugrul & Hegde (2009)	1,618 for ISS ratings, 1,487 for Governance Metrics International (GMI) ratings; 4.820 for TCL; period 2004-2006	Proprietary indices: ISS Corporate Governance Quotient (CGQ); TCL and GMI ratings	Pooled OLS	Negative and positive
Bhagat & Bolton (2008); Bhagat et al. (2008)	1500 U.S. firms; period 1999-2002	Academic and propietry indices: Gompers. Ishii, and Metrick's (GIM) G-Index; Bebchuck, Cohen, and Ferrell's (BCF E) Index; Glass Lewis; The Corporate Library's index (TCL) Benchmark score; Brown and Caylor Gov-score; Brown and Caylor Gov-7	2SLS-3SLS	Negative or none
Larcker et al. (2007)	2,106 U.S. listed firms included in the major indices (e.g., Fortune 500, S&P Super 1500), period 2002-2003	Principal component analysis, obtaining 14 factors that retain 61.7 percent of the total variance of 37 corporate governance criteria	Pooled OLS, Recursive partitioning	Negative or none
Klapper & Love (2004)	374 companies emerging markets, year 2000	CLSA Governance index (Corporate Governance and Sustainability in Asia)	Pooled OLS	Positive
Yermack (1996)	452 U.S. industrial corporations, period 1984-1991	Board size and board independence	Pooled OLS, Fixed Effects	Negative and positive

Table 5. Univariate analysis: difference in means and medians.

Panel A. Performance variables

		Non-financial			Financial		Non-financial vs. Financial	
	N	Mean	Median	N	Mean	Median	t-test	Wilcoxon
roa	11267	0.13600	0.0480	2312	0.063500	0.133	0.0725***	44.5699***
netincroa	11477	0.04979	0.0150	2624	0.024233	0.0546	0.0256***	33.5886***
ebitroa	11304	0.092685	0.0343	2565	0.047173	0.0916	0.0455***	37.3308***
roic	11178	10.25598	6.090	2586	6.908995	9.840	3.347***	21.8197***
nroe	10903	0.158406	0.109	2558	0.155275	0.138	0.0031	12.1877***
salesgrowth	10550	0.097221	0.0496	2404	0.073184	0.0787	0.024***	8.493***

Panel B. Corporate governance variables

		Non-financial			Financial		Non-financial vs. Financial	
	N	Mean	Median	N	Mean	Median	t-test	Wilcoxon
ncgvi	8293	0.739	0.695	1878	0.672	0.777	0.067***	18.5636***
aqcg_d	8293	-0.0134	0.00417	1878	0.0223	0.00494	-0.036*	0.4153

Panel C. Firm-specific characteristics

		Non-financial			Financial		Non-financial vs. Financial	
	N	Mean	Median	N	Mean	Median	t-test	Wilcoxon
lmv	11934	8.511	8.369	2718	8.510	8.384	0.001	-0.7939
lsale	11528	15.06	14.44	2631	14.66	15.05	0.40***	16.9167***
mtb2	10578	1.994	1.100	1929	1.372	1.582	0.622***	30.1842***
nvolreturn	11820	0.0920	0.0587	2691	0.0784	0.0783	0.0136***	18.7087***
lbusegm	11647	1.250	1.386	2663	1.220	1.386	0.03*	3.4509***
lage2fndinc	10906	3.320	3.246	2465	3.081	3.367	0.239***	11.4142***
ltdebtasset	11460	0.231	0.109	2617	0.203	0.208	0.028***	8.4966***
insider	12571	0.0369	0.0104	2873	0.0467	0.0067	-0.0098***	-9.135***
institution	12571	0.824	0.832	2873	0.771	0.872	0.053***	10.6084***
concentration	12571	0.236	0.193	2873	0.226	0.202	0.01**	5.4563***

Notes: See Table A1 for the definition of the variables. *** p<0.01, ** p<0.05, * p<0.1. The t-tests and Wilcoxon tests examine the mean and median differences across the sub-samples, respectively.

Table 6. The effect of current corporate governance on current company performance.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Fixed Effects	Fixed Effects	PCSE	PCSE	Fixed Effects Non-financial	Fixed Effects Financial	Fixed Effects Non-financial	Fixed Effects Financial	Fixed Effects Crisis	Fixed Effects Crisis
ncgvi	-0.00719		-0.0113		-0.0204*	-0.0103			-0.0140	
	(0.00736)		(0.00805)		(0.0117)	(0.00788)			(0.0221)	
aqcg_d		-0.0203***		-0.0157***			-0.0204***	-0.0216***		-0.0435***
		(0.00699)		(0.00485)			(0.00689)	(0.00481)		(0.0126)
Lmv	0.00615*	0.00750*	0.00995***	0.0106***	0.00196	0.00672***	0.00305*	0.00806***	0.00753**	0.0107***
	(0.00336)	(0.00352)	(0.00176)	(0.00178)	(0.00180)	(0.00116)	(0.00185)	(0.00119)	(0.00317)	(0.00326)
mtb2	0.0462***	0.0459***	0.0367***	0.0367***	0.0702***	0.0440***	0.0699***	0.0437***	0.0534***	0.0528***
	(0.00958)	(0.00970)	(0.00241)	(0.00240)	(0.00227)	(0.00110)	(0.00226)	(0.00109)	(0.00304)	(0.00302)
nvolreturn	-0.343***	-0.337***	-0.149***	-0.150***	-0.195***	-0.373***	-0.184***	-0.370***	-0.500***	-0.478***
	(0.0516)	(0.0514)	(0.0433)	(0.0432)	(0.0281)	(0.0238)	(0.0284)	(0.0238)	(0.0623)	(0.0624)
lbusegm	-0.000483	-0.000407	-0.00327	-0.00315	-0.0111***	0.00246	-0.0118***	0.00251	-0.000705	-0.000257
	(0.00362)	(0.00360)	(0.00354)	(0.00352)	(0.00362)	(0.00231)	(0.00358)	(0.00230)	(0.00600)	(0.00597)
lage2fndinc	0.00516***	0.00572***	0.00606***	0.00640***	-0.000114	0.00554***	0.000492	0.00608***	0.00611*	0.00747**
	(0.00156)	(0.00164)	(0.00188)	(0.00188)	(0.00219)	(0.00141)	(0.00219)	(0.00141)	(0.00368)	(0.00367)
ltdebtasset	-0.0201	-0.0196	-0.0616***	-0.0602***	0.0300***	-0.0359***	0.0287***	-0.0350***	-0.00253	-0.00332
	(0.0317)	(0.0317)	(0.0127)	(0.0126)	(0.00923)	(0.00715)	(0.00920)	(0.00713)	(0.0176)	(0.0175)
Constant	0.00807	-0.0104	-0.000477	-0.0158	0.00727	0.0164	-0.0174	-0.00384	-0.0162	-0.0611*
	(0.0255)	(0.0278)	(0.0186)	(0.0190)	(0.0213)	(0.0133)	(0.0216)	(0.0135)	(0.0336)	(0.0340)
N	8,412	8,412	8,412	8,412	1,147	7,265	1,147	7,265	1,381	1,381
R^2	0.274	0.276	0.191	0.193	0.514	0.267	0.516	0.269	0.273	0.279
Number of firms	1,075	1,075	1,075	1,075	173	902	173	902	806	806
F/Wald statistics	48.09***	81.59***	1485.341***	1508.31***	62.74***	139***	63.36***	140.3***	63.88***	65.87***

Notes: Robust standard errors are in the parentheses. *** p<0.01, ** p<0.05, * p<0.1. PCSE stands for panel-corrected standard errors. Time dummies are included in all models. Standard errors are clustered by industry for the fixed effects models. The dependent variable is ROA in all models.

Table 7. The effect of current corporate governance on future company performance.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Fixed Effects ROA_{t+1}	Fixed Effects ROA_{t+1}	PCSE ROA_{t+1}	PCSE ROA_{t+1}	Fixed Effects ROA_{t+2}	Fixed Effects ROA_{t+2}	PCSE ROA_{t+2}	PCSE ROA_{t+2}	Fixed Effects ROA_{t+1} to ROA_{t+2}	Fixed Effects ROA_{t+1} to ROA_{t+2}	PCSE ROA_{t+1} to ROA_{t+2}	PCSE ROA_{t+1} to ROA_{t+2}
ncgvi	-0.00178		0.00343		-0.00616		-0.00544		-0.00567		-0.00008	
	(0.00544)		(0.00875)		(0.00610)		(0.00948)		(0.00553)		(0.00630)	
aqcg_d		-0.0175*		-0.00937*		-0.0189**		-0.0120**		-0.0200*		-0.00789**
		(0.00835)		(0.00521)		(0.00816)		(0.00573)		(0.00886)		(0.00388)
lmv	0.00565*	0.00694*	0.00613***	0.00687***	0.00535	0.00666*	0.00475**	0.00544***	0.00524	0.00666*	0.00293*	0.00347**
	(0.00302)	(0.00336)	(0.00180)	(0.00180)	(0.00311)	(0.00341)	(0.00192)	(0.00193)	(0.00298)	(0.00332)	(0.00167)	(0.00167)
mtb2	0.0474***	0.0472***	0.0414***	0.0413***	0.0433***	0.0431***	0.0336***	0.0335***	0.0457***	0.0454***	0.0328***	0.0328***
	(0.00892)	(0.00906)	(0.00246)	(0.00244)	(0.00824)	(0.00839)	(0.00251)	(0.00250)	(0.00827)	(0.00842)	(0.00222)	(0.00222)
nvolreturn	-0.298***	-0.292***	-0.153***	-0.153***	-0.229***	-0.224***	-0.103***	-0.103***	-0.246***	-0.240***	-0.0745***	-0.0747***
	(0.0747)	(0.0741)	(0.0407)	(0.0406)	(0.0676)	(0.0675)	(0.0395)	(0.0393)	(0.0685)	(0.0680)	(0.0284)	(0.0284)
lbusegm	0.00107	0.00117	0.00154	0.00165	0.00191	0.00199	0.000431	0.000503	0.00205	0.00214	0.00258	0.00266
	(0.00375)	(0.00383)	(0.00344)	(0.00342)	(0.00352)	(0.00362)	(0.00395)	(0.00393)	(0.00349)	(0.00359)	(0.00313)	(0.00312)
lage2fndinc	0.00553***	0.00611***	0.00681***	0.00719***	0.00501***	0.00557***	0.00517**	0.00551***	0.00482***	0.00542***	0.00545***	0.00572***
	(0.00107)	(0.00120)	(0.00193)	(0.00192)	(0.00126)	(0.00127)	(0.00206)	(0.00206)	(0.00102)	(0.00107)	(0.00181)	(0.00180)
ltdebtasset	0.0164	0.0167	0.0360***	0.0359***	0.0158	0.0164	0.00298	0.00361	0.0144	0.0150	0.0266**	0.0267**
	(0.0157)	(0.0157)	(0.0134)	(0.0133)	(0.0158)	(0.0159)	(0.0153)	(0.0152)	(0.0159)	(0.0160)	(0.0118)	(0.0117)
Constant	0.000355	-0.0141	-0.00981	-0.0147	0.0192	0.00161	0.0430**	0.0321	0.0124	-0.00583	0.0355**	0.0299*
	(0.0243)	(0.0262)	(0.0188)	(0.0189)	(0.0202)	(0.0216)	(0.0204)	(0.0206)	(0.0208)	(0.0227)	(0.0172)	(0.0173)
N	7,875	7,875	7,875	7,875	7,072	7,072	7,072	7,072	7,015	7,015	7,015	7,015
R^2	0.251	0.252	0.189	0.191	0.202	0.204	0.155	0.156	0.292	0.294	0.256	0.257
Number of firms	1,070	1,070	1,070	1,070	1,049	1,049	1,049	1,049	1,046	1,046	1,046	1,046
F/Wald statistics	405.63***	266.33***	1515.88***	1530.44***	83.80***	317.33***	1184.80***	1196.01***	59.56***	1465.37***	1405.53***	1420.08***

Notes: Robust standard errors are in the parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$. PCSE stands for panel-corrected standard errors. Time dummies are included in all models. Standard errors are clustered by industry for the fixed effects models. The dependent variable is a) ROA_{t+1} in models 1-4; b) ROA_{t+2} in models 5-8; and c) average of ROA_{t+1} and ROA_{t+2} in models 9-12.

Table 8. The effect of corporate governance on company performance and value: robustness checks.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Fixed Effects ROA$_t$	Fixed Effects ROA$_t$	PCSE ROA$_t$	PCSE ROA$_t$	IV ROA$_t$	IV ROA$_t$	Fixed Effects Tobin's Q$_t$	Fixed Effects Tobin's Q$_t$	PCSE Tobin's Q$_t$	PCSE Tobin's Q$_t$
ncgvi	-0.0182**		-0.0143*		-0.0208***		0.230		0.180***	
	(0.00794)		(0.00825)		(0.00750)		(0.1550)		(0.0644)	
aqcg_d		-0.0273***		-0.0173***		-0.0295***		0.325***		0.126***
		(0.00658)		(0.00504)		(0.00440)		(0.0677)		(0.0377)
lsale	0.0114**	0.0125**	0.0120***	0.0125***	0.0121***	0.0134***	-0.196***	-0.208***	-0.185***	-0.187***
	(0.00411)	(0.00427)	(0.00204)	(0.00206)	(0.000987)	(0.00100)	(0.0368)	(0.0412)	(0.0195)	(0.0194)
mtb2	0.0499***	0.0502***	0.0410***	0.0413***	0.0505***	0.0509***				
	(0.00866)	(0.00860)	(0.00234)	(0.00233)	(0.00103)	(0.00103)				
nvolreturn	-0.334***	-0.330***	-0.146***	-0.148***	-0.311***	-0.307***	-0.0390	-0.0648	-0.896***	-0.901***
	(0.0456)	(0.0459)	(0.0411)	(0.0410)	(0.0205)	(0.0204)	(0.385)	(0.366)	(0.294)	(0.295)
lbusegm	-0.00381	-0.00388	-0.00550	-0.00545	-0.00278	-0.00290	-0.0436	-0.0423	-0.0526*	-0.0525*
	(0.00420)	(0.00427)	(0.00366)	(0.00362)	(0.00215)	(0.00215)	(0.0543)	(0.0559)	(0.0313)	(0.0309)
lage2fndinc	-0.00105	-3.25e-05	0.00480	0.00521	0.00199	0.00301	0.118	0.105	0.0682	0.0667
	(0.0165)	(0.0163)	(0.0101)	(0.0100)	(0.00659)	(0.00657)	(0.141)	(0.142)	(0.0826)	(0.0823)
l2age2fndinc	0.000856	0.000758	5.49e-05	2.57e-05	0.000411	0.000312	-0.0278	-0.0265	-0.0199	-0.0198
	(0.00259)	(0.00259)	(0.00155)	(0.00153)	(0.00103)	(0.00103)	(0.0250)	(0.0250)	(0.0126)	(0.0126)
ltdebtasset	-0.0204	-0.0194	-0.0658***	-0.0641***	0.0140**	0.0152**	-0.332	-0.342	-0.181*	-0.190*
	(0.0332)	(0.0330)	(0.0129)	(0.0128)	(0.00700)	(0.00698)	(0.276)	(0.272)	(0.109)	(0.108)
insider	0.0927**	0.0902**	0.0721***	0.0708***	0.0936***	0.0906***	0.295	0.319	0.685***	0.691***
	(0.0371)	(0.0363)	(0.0257)	(0.0256)	(0.0177)	(0.0176)	(0.373)	(0.380)	(0.204)	(0.204)
concentration	-0.0315*	-0.0374**	-0.0191	-0.0218*	-0.0374***	-0.0436***	0.216	0.283	0.0552	0.0631
	(0.0170)	(0.0157)	(0.0129)	(0.0129)	(0.00985)	(0.00980)	(0.245)	(0.291)	(0.0903)	(0.0905)
institution	0.0564**	0.0553**	0.0513***	0.0506***	0.0540***	0.0527***	-0.729**	-0.713**	-0.480***	-0.483***
	(0.0218)	(0.0209)	(0.0143)	(0.0142)	(0.00940)	(0.00938)	(0.295)	(0.285)	(0.0922)	(0.0925)
roa							4.568***	4.587***	1.860***	1.912***
							(0.835)	(0.833)	(0.160)	(0.161)
Constant	-0.136*	-0.167**	-0.133***	-0.152***	-0.149***	-0.184***	4.658***	4.999***	4.527***	4.689***
	(0.0610)	(0.0632)	(0.0407)	(0.0415)	(0.0228)	(0.0230)	(0.689)	(0.696)	(0.344)	(0.350)
N	8,346	8,346	8,346	8,346	7,986	7,986	8,346	8,346	8,346	8,346
R^2	0.285	0.288	0.196	0.198	0.326	0.329	0.303	0.308	0.321	0.321
Number of firms	1,062	1,062	1,062	1,062	1,056	1,056	1,062	1,062	1,062	1,062
F/Wald statistics	10.17***	19.60***	1408.84***	1434.42***	3889.39***	3943.57***	50.60***	45.37***	2394.31***	2427.17***

Notes: Robust standard errors are in the parentheses. *** p<0.01, ** p<0.05, * p<0.1. PCSE stands for panel-corrected standard errors. Time dummies are included in all models. Standard errors are clustered by industry for the fixed effects models. IV stands for the instrumental variables method to tackle the endogeneity problem. *l2age2fndinc* is squared values of *lage2fndinc*. The dependent variable is a) ROA in models 1-6 and b) Tobin's Q (i.e., the variable *mtb2* as defined in table A1) in models 7-10.