

Does asset risk influence corporate governance in the Spanish Continuous Market?

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Abstract

Purpose – This study examines the relationship between corporate governance and asset risk estimation models at the aggregate and sector-specific levels.

Theoretical framework – The European Union promotes best practices in corporate governance, and as a result Spain requires compliance with the Corporate Governance Report and Recommendations.

Design/methodology/approach – Using accounting information and mandatory public disclosures, the study estimates multiple linear regression models to examine the relationship between the main dimensions of corporate governance (remuneration, monitoring and governance structure) and asset risk.

Findings – At the cross-sectoral level, the analysis shows that most of the variability in asset risk depends on two control variables (size and membership of the financial sector) and one variable related to corporate governance (the percentage of proprietary directors). The results do not provide statistically significant evidence to support the hypotheses concerning the variables related to corporate governance, which justifies the need for a sectoral analysis. Once intersectoral heterogeneity is eliminated, the presence of blockholders, executive remuneration, the existence of proprietary directors, and the number of board meetings explain a significant proportion of the intrasectoral variability.

Practical & social implications of research – Regulators can promote governance structures; investors can assess their risk profile based on the size and sector of the firm; and boards of directors can adapt corporate governance to their sector.

Originality/value – The study uses mandatory public information available since 2018 to examine the link between corporate governance and asset risk, highlighting cross-sectoral heterogeneity and the need for sectoral analysis.

Keywords: Corporate governance, corporate governance management, board of directors, remuneration.

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1 Introduction

Corporate governance (CG) encompasses the policies, laws and instruments involved in managing and governing a company (Solomon, 2020). It has the most direct impact on employees and shareholders: shareholders perceive it through dividends, while employees perceive it through their working conditions (Buallay et al., 2017). The predominant theoretical framework in CG studies (Iskander & Chamlou, 2000; Beiner et al., 2006; Adams et al., 2010; Pande & Ansari, 2014) is agency theory (Jensen & Meckling, 1976). Its popularity is due to two characteristics (Daily et al., 2003):

- i) It reduces decision-making to two groups – management and shareholders – with clearly defined, divergent interests (Daily et al., 2003);
- ii) It assumes that human beings are intrinsically selfish (Okibe, 2020), so every rational individual pursues their own interests.

However, other theoretical approaches also address sound CG. Stewardship theory posits that ethical and professional motivations may prevent conflicts of interest between managers and shareholders (Muth & Donaldson, 1998). This theory offers an alternative view to agency theory within the domain of CG, assuming that managers act as stewards of organisational interests, guided by intrinsic values and a sense of responsibility towards the owners (Davis et al., 1997). Resource dependence theory (Pfeffer, 1973; Pfeffer & Salancik, 2015) argues that a board of directors that is well connected to its external environment is better positioned to access strategic resources, such as financial capital, which can be allocated to sustainable initiatives. Institutional theory (Scott, 2008) suggest that if CG prioritises legitimacy over economic efficiency (Carver, 2010), social welfare and stakeholder balance become central elements (Hess & Warren, 2008; Johanson & Østergren, 2010). Finally, stakeholder theory (Freeman & Reed, 1983; Freeman, et al., 2010) suggests that the board of directors should consider all groups that may have a legitimate interest in the company.

Many studies have investigated the relationship between CG and risk. Some have found a link between CG and the effective management of a company's affairs (Eling & Marek, 2014). Others have linked agency theory to the capital–risk binomial (Baranoff et al., 2007).

While most studies establish a positive relationship between the two variables (Cummins & Sommer, 1996; Chen et al., 2001; He & Sommer, 2011), some consider risk to be restrictive (Boubakri, 2011), and a few report that the relationship between the two variables can be either negative or positive (John et al., 2008). This research therefore analyses asset risk (AR) in companies in the Spanish Continuous Market (SCM) and its relationship with CG.

Spain offers a distinctive context for CG research within the European Union (EU). Its corporate landscape is characterised by concentrated ownership structures, a high prevalence of family-owned firms and proprietary directors, which differ markedly from the dispersed ownership systems found elsewhere (Gutierrez & Surroca, 2014; Benin et al., 2025). Furthermore, Spain recently introduced strict governance and sustainability regulations, including Law 11/2018 on non-financial and diversity disclosure. This aligns with EU directives, promoting transparency and environmental, social and governance (ESG) compliance (Anguiano-Santos & Rodríguez-Entrena, 2024). These institutional and structural features make Spain an ideal setting for examining how governance mechanisms influence AR.

The correct implementation of internal CG mechanisms reduces risk, which in turn increases invested capital and improves company performance. Previous research has focused on governance and company performance. Various measures have been used, based on operational, market or financial indicators (Buallay et al., 2017). When analysing CG components, most studies focus on return on assets (ROA) (Eling & Marek, 2014).

However, a research gap remains regarding the link between governance structures and risk in general and AR in particular (Alzayed et al., 2024; Kalia & Gill, 2023). Most studies treat risk as either a control variable or an approximation of performance, ignoring the fact that these two concepts measure different aspects of corporate behaviour. Performance reflects actual results, whereas risk captures uncertainty and variability in asset value.

The main objective of this manuscript is to examine the influence of CG instruments on the AR of companies in the SCM, using publicly available information from 2018 to 2019. To achieve this, the above theories and the academic literature are analysed to identify CG-related variables that are relevant to corporate risk. The relationship between the main CG dimensions (remuneration, monitoring and governance structure) and AR is empirically determined using opportunity asset risk (OAR) and appropriate econometric techniques.

Both cross-sectional and sectoral analyses are also carried out to determine the existence of sectoral homogeneity.

This paper makes several contributions to the literature on CG. First, it complements traditional performance-based analyses (John et al., 2008; Laeven & Levine, 2009) by studying the influence of governance on companies' risk profiles. To this end, it determines how a series of variables representing the different dimensions of CG influence AR, as measured by OAR. Second, it reveals that most of the variability in AR at the cross-sectoral level is explained by variables unrelated to CG. This highlights the need to analyse this phenomenon by conducting a sectoral analysis. Third, the sectoral analysis reveals intersectoral heterogeneity and identifies patterns governing the relationship between AR and CG in different economic sectors. It also enables the determination of the dimensions and variables representative of CG that influence AR at the intra-sectoral level.

To address these objectives, the paper is structured as follows. Section 2 reviews CG and its relationship with risk, and develops the hypotheses. Section 3 presents the research methodology and data and determines the variables that can help measure SCM companies' AR. Section 4 explains the modelling process, how each variable is measured and the results obtained through the empirical study, both globally and by productive sector. Section 5 provides the most relevant conclusions.

2 Literature review

Governance codes aim to establish principles for good CG and are based on transparency (Fung, 2014; Solikhah & Maulina, 2021), accountability (Ramaswamy et al., 2008; Solomon, 2020) and a long-term focus (Salvioni et al., 2018). They develop regulations and good practices for companies (Ghani & Rosdi, 2019), enabling higher performance (Todorovic, 2013; Lu & Wang, 2021), fostering growth (Tandukar et al., 2019) and promoting business stability (Wood & Small, 2019).

In 1958, Modigliani and Miller (1958) proposed a classic approach to risk. Among these approaches, AR is widely used in the literature. Cummins and Sommer (1996) relate it to the risk derived from the products that the company markets, studying the relationship between risk and asset capital in different areas. Berger et al. (1995) and Jacques and Nigro (1997) focus on the banking sector. The results of these studies are inconclusive, but suggest that the concept depends on the period, area and/or sector analysed.

In the present study, the concept is measured using OAR, which was proposed and analysed by Baranoff et al. (2007).

Agency theory provides a framework for understanding how the relationship between principals and agents influences AR management decisions (Dalton et al., 2007). It highlights the need for balanced incentives and effective governance structures to manage risk appropriately (Demsetz et al., 1997). Within this framework, the incentive and control mechanisms applied to executives and directors influence the risk profile of a firm's assets (Fama & Jensen, 1983; Jensen & Meckling, 1976; Jensen, 1986). A substantial body of research has shown that governance can either constrain or encourage risk-taking, depending on the design of incentive schemes and the effectiveness of monitoring (John et al., 2008; Ellul & Yerramilli, 2013). In regulated and/or capital-intensive industries in particular, the architecture of the board and ownership structure shape asset allocation and, consequently, the volatility of aggregate corporate portfolio returns (Pathan, 2009; Laeven & Levine, 2009). Companies with a lower level of leverage also tend to have lower regulatory costs due to lower exposure to insolvency risk (Shrieves & Dahl, 1992). The negative relationship between AR and capital is based on the risk-return trade-off: the return on the funds or deposits of large institutions is lower than that of higher-risk investments (Cummins, 1988).

Beyond agency theory, alternative theoretical frameworks offer valuable insights into how CG influences business decision-making and AR. Stewardship theory suggests that when empowered and trusted, managers are more likely to act in the best interests of the organisation, driven by intrinsic motivations and professional ethics rather than opportunistic behaviour (Davis et al., 1997). According to this perspective, firms that are governed by stewardship principles may adopt strategies that are more long-term and risk-conscious, and that align with organisational sustainability. Resource dependence theory emphasises the strategic importance of board composition and external connections in securing vital resources, which can directly affect a firm's ability to manage financial and operational risks (Pfeffer & Salancik, 2015). Boards with strong external networks are better positioned to anticipate and mitigate asset-related risks through informed decision-making and resource mobilisation. Moreover, institutional theory highlights the influence of legitimacy and normative pressures on CG practices. It suggests that firms operating in environments with robust institutional expectations may adopt governance structures that prioritise transparency and stakeholder engagement.

This reduces reputational and regulatory risk (Scott, 2008; Johanson & Østergren, 2010). Together, these theoretical perspectives enrich our understanding of how governance mechanisms shape corporate behaviour and risk exposure, offering an alternative to the limitations of agency theory.

AR is measured using adjusted book values, as required by the CNMV, the body responsible for guaranteeing and monitoring the operations of companies listed on the SCM. AR is calculated using the methodology employed by Jacques and Nigro (1997), Santomero and Babbel (1997) and Baranoff and Sager (2002), and is then applied to the SCM. Similarly, AR and the main variables used to measure CG are analysed to determine whether they are related and, if so, the nature of the relationship. This approach is similar to that used by Eling and Marek (2014). In this study, therefore, AR is proxied by the volatility of firm asset returns, derived from market and financial indices weighted by the firm's asset structure. This methodology follows those employed in finance and insurance research to link AR with governance (Jacques & Nigro, 1997; Baranoff & Sager, 2002). This parsimonious measure captures the aggregate economic risk associated with investment and financing decisions, which may be affected by governance mechanisms.

It is important to emphasise that, for adequate CG, transparency provides useful information to shareholders (Mechelli & Cimini, 2021) and facilitates investment in companies (Cai et al., 2019). It also gives investors confidence in the companies they invest in (La Rosa et al., 2019; Shahid & Abbas, 2019) and reduces risk. Additionally, it enhances a company's reputation (Orzes et al., 2020) and lends it legitimacy in the eyes of stakeholders and society (Rossignoli et al., 2021). There are three approaches to addressing CG: remuneration, monitoring and governance structure. The EU considers these when evaluating the quality of CG disclosures. Above all, optimal CG is the company's own responsibility (Rajoria, 2020), and there are national and EU-level rules to ensure certain good CG criteria are met. Many EU countries have recently adopted codes of good practice to provide listed companies with guidelines to improve the overall quality of CG. In Spain, for example, the government provides recommendations for classifying specific CG for each company (España, 2021). Good, transparent CG is essential for increasing the competitiveness (Davies & Schlitzer, 2008; Berinde, 2018; Laksito & Ratmono, 2021) and efficiency of business activity in the EU, as well as for strengthening the protection of shareholders' and third parties' rights and reducing risk.

2.1 Executive remuneration or compensation (COM)

Executive remuneration is the total remuneration received by senior managers in companies. This can be monetary or in-kind, may be fixed or variable, and may or may not be linked to performance. It is a tool that enables the degree of risk aversion and management decisions to align with the interests of other company stakeholders. The design and structure of executive remuneration influence the profitability, risk and stability of companies.

Several studies incorporate remuneration into AR models, linking it to the assessment of CG (Baranoff & Sager, 2009). Remuneration may be positively correlated with business risk (Werner et al., 2005; Laeven & Levine, 2009). Indeed, managers of firms that undertake higher-risk activities are expected to receive greater compensation (Grace, 2004). However, managerial risk aversion can influence decision-making (Eling & Marek, 2014), which can result in a positive or negative relationship with risk (Milidonis & Stathopoulos, 2011). Higher remuneration levels have also been associated with less risky decisions and, consequently, with stronger CG (Iatridis, 2018).

Remuneration can either align or misalign incentives and risk. Higher pay sensitivity to stock price, particularly volatility, tends to increase risk appetite (Coles et al., 2006; Laeven & Levine, 2009). Evidence suggests that equity and performance-based compensation structures can encourage investment in higher-variance projects, thereby increasing the risk of the asset portfolio (Cheng et al., 2015; Chesney et al., 2020). Conversely, fixed components or more conservative pay mixes can mitigate this effect, particularly in settings where the cost of failure is high.

The literature shows that the relationship between AR and executive remuneration is ambiguous and depends on the business context (company activity, organisational culture and sector), as well as the characteristics of executives (their expectations and degree of risk aversion) and of remuneration itself (its relative level and the design of the remuneration package).

Based on the available data (total compensation), the most parsimonious theoretical prediction in this study is a positive association between COM and AR. This is consistent with performance-seeking incentives, as well as with the greater scale and complexity associated with larger remuneration packages (Coles et al., 2006; Laeven & Levine, 2009).

On this basis, the first hypothesis is formulated as follows:

H₁ (COM): Executive compensation (COM) is positively associated with AR.

2.2 Monitoring (MEET, IND, EJ and NCA)

Monitoring comprises the oversight and control mechanisms through which shareholders address agency issues that arise from delegating management responsibilities to executives. These instruments are primarily implemented by the board of directors and other internal corporate governance structures. The objective of these instruments is to reduce agency costs, influence decision-making and align the interests of managers and owners. This reduces excessive risk-taking and the risks associated with human error.

Board oversight directly influences corporate risk-taking. Increased monitoring by the board tends to constrain managerial decision-making power, thereby reducing exposure to excessive risks (Pathan, 2009; Brick & Chidambaran, 2008). However, when investor and executive interests are aligned, risk-taking may intensify. This has led to an on-going debate in the literature regarding its implications. In this context, an unusually high frequency of board meetings (MEET) may reflect risk-oriented management, particularly in conditions of heightened uncertainty or operational challenges. This has been associated with greater risk, both *ex ante* and *ex post* (Eling & Marek, 2014; Vafeas, 1999).

The relationship between monitoring and risk is not unidirectional, but rather contingent on the risk preferences of the stakeholder group prioritised by the board (Eling & Marek, 2014). Managerial ownership can align the interests of executives with those of shareholders, thereby legitimising strategic decisions made by top management. In highly concentrated ownership structures, however, managers are subject to stricter scrutiny, which constrains their autonomy and shapes the policies adopted.

A substantial body of research has examined the role of board independence (IND) as a control mechanism. Greater independence enhances the oversight of risky investment decisions, thereby reducing overall risk (Agrawal & Knoeber, 1996; Pathan, 2009; Ellul & Yerramilli, 2013), and there is evidence of a positive correlation between independence and the quality of CG (Chen et al., 2015). Conversely, a greater presence of executives (EJ) on the board may weaken monitoring and

facilitate engagement in projects with greater variance in outcomes (Hermalin & Weisbach, 1991; John et al., 2008).

The empirical findings regarding board gender diversity (NCA) are mixed. Some studies suggest that greater diversity is associated with lower volatility, a reduced risk of bankruptcy, and more cautious decision-making behaviours (Sila et al., 2016; Faccio et al., 2016). However, others suggest that diversity may intensify internal debate and encourage riskier strategic decisions (Adams & Ferreira, 2009), indicating the possibility of nonlinear effects. Nevertheless, the inclusion of women on boards enhances monitoring and contributes positively to CG (Majumder et al., 2017), leading to greater discipline in decision-making and a reduction in firm risk, particularly litigation, failure, operational risks and to a lesser extent, insolvency risk (Teodósio et al., 2021).

Previous evidence suggests that the relationship between risk and monitoring is ambiguous and requires consideration of multiple facets. In particular, the effect of oversight on risk depends on the degree to which the interests of various stakeholders are aligned, and on the priority that the board gives to their interests. The design of monitoring instruments, particularly ownership and control concentration and gender diversity on the board, can amplify or attenuate this effect, thereby adding heterogeneity to the company's risk profile.

Based on this, the following hypotheses are formulated:

H2a (MEET): Board meeting frequency (MEET) is positively associated with AR.

H2b (IND): The proportion of independent directors (IND) is negatively associated with AR.

H2c (EJ): The proportion of executives inside directors (EJ) is positively associated with AR.

H2d (NCA): Board gender diversity (NCA) is negatively associated with AR.

2.3 Governance structure (ADV, DOM)

The governance structure comprises the institutional instruments through which supervisory and control rights and incentives are allocated within the company, particular the ownership structure and the configuration of the board of directors. The governance structure determines the company's risk profile, influencing the degree of risk aversion and strategic decision-making. Its purpose is to align the interests of the various stakeholders.

Previous studies have shown a positive relationship between controlling shareholders and CG with respect to the promotion of efficiency (Huang & Wang, 2015). However, an increase in the number of controlling shareholders (ADV) expands the pool of investors while the firm's portfolio remains undiversified (Eling & Marek, 2014), thereby increasing risk. Moreover, some authors argue that controlling shareholders may extract private benefits at the expense of minority shareholders (Douma et al., 2006; Grosman et al., 2019). Similarly, highly concentrated voting power can influence decision-making and consequently the associated risks. Stakeholders may also attempt to increase the value of their shares by indirectly increasing risk exposure (Cole et al., 2011). In addition, instability in ownership structures has been shown to negatively affect risk (Cheng et al., 2011).

Significant ownership blocks (i.e. majority shareholders) can mitigate corporate risk-taking, thereby reducing the variance of investment decisions (Edmans & Holderness, 2017; Laeven & Levine, 2009). However, at very high levels, there may be incentives for rent extraction or risk transfer (e.g., to creditors or minority

shareholders), which can lead to nonlinear relationships (Grosman et al., 2019; Sun et al., 2016). The presence of proprietary directors, who represent these blocks, is often associated with greater project scrutiny and consequently lower AR (Nguyen & Nielsen, 2010; Pathan, 2009).

Previous studies indicate that the relationship between AR and governance structure is not uniform, but depends on the degree of control concentration, ownership structure stability and incentive alignment. Shareholders with a significant stake or decision-making power can reduce risk when acting as a disciplinary and supervisory instrument, but can increase it when engaging in opportunistic behaviour aimed at obtaining private benefits at the expense of minority shareholders.

Therefore, the following hypotheses are formulated:

H3a (ADV): Ownership concentration by blockholders (ADV) is negatively associated with AR.

H3b (DOM): The proportion of proprietary directors (DOM) is negatively associated with AR.

The hypotheses formulated in this study, which aim to empirically test the relationship between CG variables and AR, are summarised in Table 1.

Table 1
Mapping of Variables, Hypotheses, and Expected Signs

Dimension	Variable (Code)	Operationalisation	Hypothesis	Expected Sign	Key References
Executive compensation	COM	Total executive compensation (cash + stock-based) per executive	$H_1: COM \rightarrow AR$	+	Coles et al. (2006), Laeven and Levine (2009), Cheng et al. (2015), Chesney et al. (2020)
Board monitoring	MEET	Number of board meetings per year	$H_{2a}: MEET \rightarrow AR$	+	Vafeas (1999), Brick and Chidambaran (2008)
Board independence	IND	% independent directors on the board	$H_{2b}: IND \rightarrow AR$	-	Pathan (2009), Ellul and Yerramilli (2013)
Insider representation	EJ	% executive/inside directors	$H_{2c}: EJ \rightarrow AR$	+	Hermalin and Weisbach (1991), John et al. (2008)
Gender diversity	NCA	% women on board	$H_{2d}: NCA \rightarrow AR$	+	Majumder et al. (2017)
Blockholders	ADV	Blockholder concentration (blockholder shares $\geq$ 5% company shares)	$H_{3a}: ADV \rightarrow AR$	-	Edmans and Holderness (2017), Laeven and Levine (2009), Sun et al. (2016), Grosman et al. (2019)
Proprietary directors	DOM	% proprietary (dominical) directors on board	$H_{3b}: DOM \rightarrow AR$	-	Nguyen and Nielsen (2010), Pathan (2009)
Controls	SIZE	$Ln(\text{Total assets})$	—	+	Consistent with CG literature
Controls	FINANCE	Financial sector dummy	—	+	Laeven and Levine (2009), Ellul and Yerramilli (2013)
Controls	IBEX	IBEX-35 member dummy	—	Ambiguous	Empirical test required

Source: The authors.

3 Data and methodology

3.1 Data

In Spain, the obligation to report non-financial information was established in 2017 and came into force in 2018. The database therefore starts with the SCM for the years 2018 and 2019. The years 2020 and 2021 were discarded to avoid the impact of the pandemic on the variables considered. The data sources used for the sample are CNMV reports published annually (Supplementary Data 1 – Database; Supplementary Data 2 – Codebook).

In this study, AR is measured by the volatility of an index representing the yield provided by the various types of assets in which the companies included in the SCM invest. The hypothesis is that the volatility of the other asset elements is low or zero. The proportion of these three asset categories in each company is obtained by combining the accounting information published by these companies, while their performance is approximated by means of the profitability of the IBEX35 index, daily Euribor interest rates and deposit rates.

As these companies belong to different sectors, and the risk and return of these elements are not observable on a daily basis, it is assumed that the return on assets is mainly determined by the volatility of three categories of goods and services:

i) equities and bonds;

ii) real estate investments;

iii) cash and other short-term financial investments.

For each company and each day, the return on assets is obtained as a linear combination of the aforementioned indices and the company's share of the three asset categories. The daily returns are then annualised, the standard deviation is calculated and, finally, the natural logarithm is obtained to smooth the values. The data were analysed using R statistical software (Supplementary Data 3 – R Script).

AR (Table 2) is examined over two years in 98 SCM companies. The accounting information comprises a panel of 2,156 data points for the dependent variables, corresponding to 1,078 annual data points (98 companies $\times$ 11 variables), which have been standardised to eliminate the temporal effect. A total of 105,840 annual data points were used for the dependent variable (98 companies $\times$ 3 indices $\times$ 360 data points).

In order to carry out the study, the descriptive data of the analysed companies were broken down according to sector, in accordance with the CNMV (Table 3).

Table 3 shows that the main sector in the SCM is basic materials, industry and construction (sector 2), followed by consumer goods (sector 3). Multiple linear regression is used to test the indicated hypotheses. This allows us to analyse the interaction of the variables, which determines the relationship of the three defined blocks with regard to CG.

Table 2
Descriptive statistics for AR

	N	Mean	Std. Dev.	Min	Max
AR	196	-5.05040401366	1.70470394617	-9.82407838635	-2.08153503013

Source: The authors.

Table 3
Frequencies of the SECTOR variable

Sector	Frequency	Percentage	Cumulative percentage
1 Oil and energy	16	8.2	8.2
2 Basic materials, industry and construction	52	26.5	34.7
3 Consumer goods	40	20.4	55.1
4 Consumer services	28	14.3	69.4
5 Financial services	24	12.2	81.6
6 Technology and telecommunications	12	6.1	87.7
7 Real estate services	24	12.2	100.0
Total	196	100.0	

Source: The authors.

3.2 Predictor model variables

Rather than focusing solely on three variables – remuneration, monitoring, and governance structure – the model has been expanded to include a broader array of variables. This enhancement involves calculating the dependent and explanatory variables more comprehensively.

Specifically, to determine asset performance volatility, AR is obtained by approximating it as the standard deviation of the daily return on each company's assets in each year. AR is given by the following expression (Equation 1):

$$AR_{it} = \sqrt{\frac{1}{N-1} \sum_{d=1}^N (r_{itd} - \bar{r}_{it})^2} \quad (1)$$

where: AR_{it} : asset risk of company i in year t ; r_{itd} : daily return of company i on day d of year t ; $\bar{r}_{it}$: mean daily return of company i in year t ; N : number of trading days in year t .

As the daily return on assets cannot be observed directly using publicly available information, the value of this variable is estimated using the OAR proposed and analysed by Baranoff et al. (2007). To do this, two assumptions are made. First, the volatility of a company's assets is primarily determined by the volatility of three asset categories:

- i) shares and bonds (M);
- ii) real estate investments (R);
- iii) cash (C).

Second, for SCM companies, the return on these three asset categories can be approximated by the daily IBEX35 return, the daily Euribor interest rate, and the deposit interest rate, respectively. Therefore, the daily return on assets is obtained as follows (Equation 2):

$$r_{itd} = w_{it,M} \cdot r_{itd,M} + w_{it,R} \cdot r_{itd,R} + w_{it,C} \cdot r_{itd,C} \quad (2)$$

where: $w_{it,j}$: weight of the j -th asset category, $j = M, R, C$, for company i in year t ; $r_{itd,j}$: daily return of the j -th asset class defined above for company i in year t .

The returns of the asset categories are obtained from the IBEX35 index, the Euribor interest rate and the interbank interest rate, respectively. The weights are obtained from the accounting information published by the companies¹.

¹ The calculation methodology used to estimate the weights is available from the authors upon request to facilitate replicability of the study.

3.2.1 Executive compensation or remuneration

Executive compensation (**COM**) (V_1) is determined by considering salary, cash and stock-based compensation (Loderer & Martin, 1997; Filatotchev & Allcock 2010). The total amount disbursed by the company to its executives is considered, irrespective of the number of directors (compensation per executive). Similarly, computations are made to derive the total board compensation on a logarithmic basis. Some studies report a positive relationship between executive compensation and risk in financial institutions (Cheng et al., 2015). Others focus on the impact of risk on compensation (Baranoff & Sager, 2009; Erkens et al., 2012; Ellul & Yerramilli, 2013) and adopt a different statistical approach.

3.2.2 Monitoring

The board serves as the company's primary decision-making entity. Therefore, effective board monitoring plays a crucial role in ensuring that decisions are made fairly and equitably, thereby safeguarding the interests of all shareholders. Torchia et al. (2015) investigated the correlation between board monitoring and CG standards in Italian companies. Their study revealed a positive association between board oversight and the quality of CG.

Board monitoring is a variable that is often measured in the literature as follows:

- Number of board meetings per year (Vafeas, 1999; Laksmana, 2008; Suteja et al., 2017; Ji et al., 2020): (**MEET**) (V_2).
- Percentage of independent members over the total (Eling & Marek, 2014): (**IND**) (V_3).
- Percentage of executive members belonging to the company's top management (Yermack, 1996; Eisenberg et al., 1998; Huang & Wang, 2015): (**EJ**) (V_4).
- Percentage of females: (**NCA**) (V_5).

3.2.3 Governance structure

As directors are part of the company, they can align their interests with those of the shareholders by sharing common goals. Additionally, management can enhance the legitimacy of their decisions by seeking the support of senior management. However, in instances of highly concentrated company ownership, management may face increased scrutiny from shareholders. This can constrain management's decision-making power, influencing the formulation of policies and strategies as shareholders closely monitor and evaluate their actions and decisions.

Previous research has indicated a positive correlation between blockholders (**ADV** (V_6)) and CG/risk, particularly in terms of enhancing efficiency (Huang & Wang, 2015). However, an increase in the number of blockholders can result in a larger pool of investors and a lack of diversification in the company's portfolio (Eling & Marek, 2014), which reduces risk. Conversely, others (Douma et al., 2006; Grosman et al., 2019) have criticised blockholders for prioritising profits for select shareholders, raising concerns about potential conflicts of interest that can increase risk.

The variables associated with blockholders make it possible to analyse the number of significant company shareholders (Edmans & Holderness, 2017). In Spain, individuals or entities holding 5% or more of a company's shares can influence company decision-making (**DOM** (V_7)). Consequently, this study examines the proportion of shareholders with voting rights and the percentage of proprietary board members, due to external influences on the company. According to Fahlenbrach and Stulz (2011), until now, the relationship between risk and blockholders has not been decisive. In principle, these types of shareholders can exercise their right to influence decisions and reduce risk. However, companies whose blockholders and boards make similar decisions do not demonstrate greater resilience to crises.

3.2.4 Control variables

Finally, based on the work of Beiner et al. (2006), two control variables are included, alongside descriptive statistics for all the variables (Table 4).

1. CNMV: **SECTOR** (V_8). This is because each one possesses unique characteristics and it is valuable to investigate whether certain variables have a more significant effect in specific sectors than in others. Thus, the CNMV's sector classification (Table 3) is used.

2. Company size: **SIZE** (V_9). This is due to the different management practices observed in larger companies (Eling & Marek, 2014). This variable, which is commonly used in governance studies, is defined as the logarithm of total assets. Larger companies are often subject to more scrutiny and analysis than smaller companies, which could potentially influence their governance practices (Eling & Marek, 2014).

Similarly, the research incorporates two additional control variables:

3. **IBEX** (V_{10}). This is the main Spanish stock market index, comprising the 35 companies with the highest capitalisation. This makes it an interesting variable to analyse.

4. The financial market: **FINANCE** (V_{11}). Most of the companies with the highest market capitalisation belong to the financial sector, so the effect of this variable is analysed.

The third and fourth variables are dichotomous, indicating whether or not the firm belongs to the IBEX35 or the financial sector. The SECTOR variable is nominal. Table 4 shows the main descriptive statistics for these variables.

Table 4
Descriptive Statistics for the Variables

Variable (Code)	Mean	Std. Dev.	Min.	Max.
AR	-5.05	1.70	-9.82	-2.08
COM	14.71	1.43	11.34	17.95
MEET	10.95	3.67	4.00	28.00
IND	43.28	14.59	0.00	85.71
EJ	16.04	10.27	0.00	42.86
NCA	0.22	0.12	0.00	0.57
ADV	31.91	24.51	0.00	94.13
DOM	30.47	20.28	0.00	75.00
SIZE	21.45	2.44	14.74	28.05
FINANCE	0.12	0.33	0.00	1.00
IBEX	0.36	0.48	0.00	1.00

Source: The authors.

3.3 Empirical model

A robust multiple linear regression analysis was performed using the Ordinary Least Squares (OLS) method and the Iteratively Reweighted Least Squares (IRLS) technique (Marx, 1996). In this model, the dependent variable (AR) is determined by a set of independent variables (V_h), which are not a linear combination of the other variables. Weights are assigned to each observation depending on whether it meets the underlying assumptions of standard multiple regressions.

This model is commonly used in the literature to predict the value of the dependent variable, evaluate the influence of the predictors on it, or both. The main advantages of this model are that it mitigates the influence of outliers and improves the reliability of the coefficient estimates. However, the main drawbacks are overfitting and a lack of robustness. This model was selected because it is considered the most appropriate for achieving the objectives of the study due to the characteristics of the sample, which comprises companies listed on the SCM during the period 2018–2019, as well as its advantages.

Thus, the regression model is as follows (Equation 3):

$$\begin{aligned} AR_{it} = & \alpha + \beta_1 \cdot COM_{it} + \beta_2 \cdot MEET_{it} + \beta_3 \cdot \\ & IND_{it} + \beta_4 \cdot EJ_{it} + \beta_5 \cdot NCA_{it} + \beta_6 \cdot ADV_{it} + \beta_7 \cdot \\ & DOM_{it} + \gamma_1 \cdot SIZE_{it} + \gamma_2 \cdot FINANCE_{it} + \gamma_3 \cdot \\ & IBEX_{it} + \gamma_4 \cdot SECTOR_{it} + \varepsilon_{it} \end{aligned} \quad (3)$$

where: α : Constant value; β_h : Linear regression coefficient, $h = 1, 2, \dots, 7$, where $\beta_1, \beta_2, \beta_4$ and $\beta_5 > 0$; β_3, β_6 and $\beta_7 < 0$; and $\gamma_1, \gamma_2 > 0$; ε_{it} : Residual or error.

3.4 Regression characteristics

In a multiple linear model, the predictors must be independent. Consequently, it is not possible to identify the individual effect that each V_h variable has on the AR variable. This results in an increase in the variance of the estimated regression coefficients, to such an extent that it is practically impossible to establish their statistical significance. To determine the degree of multicollinearity of the variables, the variance inflation factor (VIF) and tolerance (TOL) of each predictor/regression coefficient were calculated.

The VIF of each predictor is calculated using the following Equation 4:

$$VIF_h = \frac{1}{1 - R_h^2} \quad (4)$$

where $h = 1, 2, \dots, 7$.

The TOL is also obtained as the inverse of the VIF (Equation 5):

$$TOL_h = \frac{1}{VIF_h} = 1 - R_h^2 \quad (5)$$

where $h = 1, 2, \dots, 7$, and R_h^2 is obtained from the regression of the V_h predictor over the other predictors. Collinearity can be categorised as zero ($VIF = 1$), low or medium ($1 \leq VIF < 5$), or high ($5 \leq VIF < 10$). The recommended limits for TOL are between 1 and 0.1.

4. SCM Results

4.1 Complete model

Based on the stepwise regression procedure and the fit of the data to the multiple linear regression model, the proposed model with the highest multiple correlation coefficient (R) is obtained.

It is important to bear in mind that the magnitude of each partial regression coefficient depends on the units in which the corresponding predictor variable (V_h , where $h = 1, 2, \dots, 7$) is measured; thus, a coefficient's magnitude is not an indication of the importance of each predictor. To determine the impact of each variable on the model, standardised partial regression coefficients are used. These are obtained by standardising the predictor variables after adjusting the model (Table 5).

The R^2 ranges from 0.343 to 0.394, while the adjusted R^2 varies from 0.340 to 0.384. The third model provides the best explanation.

Levene's statistic (Table 6) shows that all the variables have a p -value less than 0.1, indicating that the equality of variances (i.e., homoscedasticity) is rejected, except for the IBEX variable.

Kleinbaum et al. (2013) provided a rule stating that there is no collinearity problem if the VIF is less than 10. In the proposed model, the values of the FINANCE, SIZE and DOM predictors are between 1.031 and 1.329, and the TOL is within the recommended limits (1 and 0.1). Thus, it can be concluded that there is no collinearity problem (Table 7).

Table 7 (Model 3) shows that the AR of companies in the SCM is determined by the variables FINANCE ($\beta' = 0.462$; $t = 6.922$; $p < 0.348$) and SIZE ($\beta' = 0.214$; $t = 3.235$; $p < 0.046$), with positive relationships, and by DOM ($\beta' = -0.118$; $t = -2.005$; $p < 0.005$), with a negative relationship. This negative relationship confirms the findings of previous studies and hypothesis H_{3b} , as presented in Section 2.3.

Table 5
Summary Statistics of the Multiple Regression Models^d

Model	R	R ²	Adjusted R ²	Standard error
1	.586 ^a	.343	.340	1.3772
2	.617 ^b	.380	.373	1.3416
3	.627 ^c	.394	.384	1.3306

^aPredictors: (Constant), FINANCE; ^bPredictors: (Constant), FINANCE, SIZE; ^cPredictors: (Constant), FINANCE, SIZE, DOM;

^dDependent variable: AR.

Source: The authors.

Table 6
Test for Homogeneity of Variances

	Levene's statistic	df1	df2	Sig.
IBEX	.138	1	194	.711
SECTOR	7.280	6	184	.000
MEET	1.629	16	174	.066
IND	1.808	29	150	.012
NCA	1.393	31	154	.098
ADV	2.023	16	34	.042
DOM	2.296	38	149	.000
COM	3.440E+29	1	2	.000

df1 and df2 denote the degrees of freedom of the numerator and denominator, respectively; Sig. represents the p-value associated with Levene's test, and p-values less than 0.10 indicate heteroscedasticity.

Source: The authors.

Table 7
Final Model. Variables Included and Coefficients^a

Model		Non-standardized coefficients		Standardized coefficients	<i>t</i>	Sig.	Collinearity	
		β	Error	β'			TOL	VIF
1	(Constant)	-5.404	.108		-50.095	.000		
	FINANCE	3.059	.313	.586	9.779	.000	1.000	1.000
2	(Constant)	-8.599	.976		-8.809	.000		
	FINANCE	2.503	.348	.479	7.185	.000	.765	1.307
	SIZE	.152	.046	.220	3.293	.001	.765	1.307
3	(Constant)	-8.202	.988		-8.300	.000		
	FINANCE	2.412	.348	.462	6.922	.000	.752	1.329
	SIZE	.148	.046	.214	3.235	.001	.764	1.309
	DOM	-.010	.005	-.118	-2.005	.046	.969	1.031

^aDependent variable: AR. Source: The authors

With a *p-value* of less than 0.05, we can accept hypothesis H_{3b} at this level of significance, indicating an inverse proportional relationship between AR and governance structure. This affirms that there is a relationship between AR and certain control variables, expressed as follows (Equation 6):

$$AR_{it} = -8.202 + 2.412 \cdot FINANCE_{it} + 0.148 \cdot SIZE_{it} - 0.01 \cdot DOM_{it} + \epsilon_i \quad (6)$$

To determine the variability explained by each of the predictors incorporated in the model, an analysis of variance (ANOVA) is used.

As with simple linear models or correlation studies, if the *F* test is not significant, the model is not valid, no matter how high the goodness of fit is, because it is unable to explain the observed variance better than would be expected by chance. The results of the ANOVA

test carried out in this study show that, for Model 3 (which incorporates these three variables), the *p-value* associated with the F-statistic is lower than the significance level (Table 8).

Table 9 rejects hypotheses H_1 , H_{2a} , H_{2b} , H_{2c} and H_{3a} , since the associated variables are IBEX ($t=-0.111$), MEET ($t=-0.038$), IND ($t=-0.12$), NCA ($t=0.072$), ADV ($t=-0.083$), COM ($t=-0.117$) and SECTOR ($t=0.009$). All of these had a *p-value* greater than 0.05.

The data analysed using Pearson's correlation coefficient (Table 10) revealed a linear relationship between the variables studied. The statistical significance of the correlation was evaluated using the *p-value* to determine whether the observed association was due to chance or reflected a consistent pattern among SCM companies. These results enable us to draw conclusions about the interdependence of the variables (values $> \pm 0.4$) and their potential application within the scope of the study.

Table 8
ANOVA^a

	Model	Sum of squares	df	Root mean square	F	Sig.
1	Regression	181.407	1	181.407	95.635	.000 ^b
	Waste	347.129	183	1.897		
	Total	528.536	184			
2	Regression	200.922	2	100.461	55.809	.000 ^c
	Waste	327.615	182	1.800		
	Total	528.536	184			
3	Regression	208.038	3	69.346	39.163	.000 ^d
	Waste	320.499	181	1.771		
	Total	528.536	184			

^aDependent variable: AR; ^bPredictors: (Constant), FINANCE; ^cPredictors: (Constant), FINANCE, SIZE; ^dPredictors: (Constant), FINANCE, SIZE, DOM.

Source: The authors.

Table 9
Final model. Variables Excluded and Coefficients^a

Model		β	t	Sig.	Partial correlation	Collinearity		
						TOL	VIF	Min TOL
1	SIZE	.220 ^b	3.293	.001	.237	.765	1.307	.765
	IBEX	.079 ^b	1.303	.194	.096	.968	1.033	.968
	MEET	-.011 ^b	-.185	.853	-.014	.950	1.053	.950
	IND	.080 ^b	1.317	.190	.097	.980	1.021	.980
	NCA	.124 ^b	2.060	.041	.151	.972	1.029	.972
	ADV	-.076 ^b	-1.274	.204	-.094	.998	1.002	.998
	DOM	-.126 ^b	-2.085	.038	-.153	.971	1.030	.971
	COM	.107 ^b	1.766	.079	.130	.962	1.040	.962
	SECTOR	-.039 ^b	-.624	.533	-.046	.924	1.083	.924
2	IBEX	-.074 ^c	-.963	.337	-.071	.581	1.720	.459
	MEET	-.052 ^c	-.852	.395	-.063	.913	1.095	.736
	IND	.026 ^c	.423	.672	.031	.899	1.112	.702
	NCA	.082 ^c	1.340	.182	.099	.915	1.093	.720
3	ADV	-.117 ^c	-1.979	.049	-.145	.963	1.039	.738
	DOM	-.118 ^c	-2.005	.046	-.147	.969	1.031	.752
	COM	-.105 ^c	-1.136	.258	-.084	.394	2.536	.314
	SECTOR	-.001 ^c	-.023	.982	-.002	.891	1.122	.682
	IBEX	-.111 ^d	-1.437	.152	-.106	.555	1.803	.454
	MEET	-.038 ^d	-.618	.537	-.046	.900	1.111	.733
	IND	-.120 ^d	-1.393	.165	-.103	.452	2.211	.452
	NCA	.072 ^d	1.185	.237	.088	.909	1.101	.720
	ADV	-.083 ^d	-1.294	.197	-.096	.812	1.231	.727
	COM	-.117 ^d	-1.273	.205	-.094	.393	2.546	.314
	SECTOR	.009 ^d	.151	.880	.011	.884	1.131	.666

^aDependent variable: AR; ^bPredictors in the model: (Constant), FINANCE; ^cPredictors in the model: (Constant), FINANCE, SIZE;

^dPredictors in the model: (Constant), FINANCE, SIZE, DOM.

Source: The authors.

In addition to the relationships between the independent variables and the AR variable, significant negative relationships were found between the DOM variable and the IND and EJ variables. In addition, positive relationships exist between COM and SIZE.

4.2 Modelling by sector

Finally, the analysis was repeated by segmenting the companies according to the industry (SECTOR) variable. Linear regression models were obtained using the stepwise method to determine the effect of the productive sector on AR. Table 11 shows the adjusted R^2 and obtained R^2 for the linear regression models segmented by sector. These values are higher than those obtained for the non-segmented models. Similarly, the characteristics of the models differ in terms of both the number of models and the variables that comprise them.

As can be seen, R^2 ranges from 0.426 to 0.738, whereas the adjusted R^2 varies between 0.369 and 0.711.

Table 11 shows the following:

- i) In the **oil and energy sector** (1), AR is affected by governance structure and monitoring (MEET), so null hypotheses H_{2a} and H_{3a} are rejected.
- ii) In the **basic materials, industry and construction sector** (2), AR is influenced by the governance structure through proprietary directors (DOM). H_{3b} is rejected.
- iii) In the **financial services sector** (5), null hypothesis H_1 is rejected through executive compensation (COM).
- iv) The **technology and telecommunications sector** (6) is influenced by blockholders (ADV), so null hypothesis H_{3a} is rejected.

Table 10
Pearson Correlations

	AR	COM	MEET	IND	EJ	NCA	ADV	DOM	SIZE
AR	1								
COM	0.038	1							
MEET	.163*	.157*	1						
IND	.184**	.174*	.306**	1					
EJ	.190**	-.202**	-.151*	.241**	1				
NCA	.233**	0.065	0.102	.304**	-0.011	1			
ADV	-0.043	-0.015	.292**	-0.056	-0.092	0.040	1		
DOM	-.187**	-0.013	0.132	-.487**	-.476**	-0.055	.398**	1	
SIZE	.466**	.404**	.271**	.285**	-0.096	.253**	.175*	-0.108	1

*The correlation is significant at the 0.05 level (two-tailed); **The correlation is significant at the 0.01 level (two-tailed).

Source: The authors.

Table 11
Summary of Variable Models by Sector

Sector	R	R ²	Adjusted R ²	Variables
1	.701	.492	.414	ADV ($t=-3.437$) MEET ($t=2.450$)
2	.792	.627	.600	SIZE ($t=7.607$) IBEX ($t=-2.717$) DOM ($t=-2.143$)
3*				--
4*				--
5	.859	.738	.711	SIZE ($t=7.238$) COM ($t=-3.939$)
6	.653	.426	.369	ADV ($t=-2.726$)
7*				--

*All the variables are excluded from the model; none of them explain AR. The data are available from the authors upon request.

Source: The authors

v) In the **consumer goods** (3), **consumer services** (4), and **real estate services** (7) sectors, the significance of the variables is insufficient to accept or reject the hypotheses.

vi) On the other hand, AR depends on economic variables, as in the cases of the **basic materials, industry and construction** (2) and **financial services** (5) sectors, which depend on company size (SIZE). Sector 2 also depends on whether or not the company belongs to the IBEX35 (IBEX).

5 Conclusions

Previous studies have analysed the effects of risk and CG on companies separately. However, the main contribution of the present research is its examination of how CG specifically influences AR in the SCM. This integrated perspective is important because, according to a systematic review of the literature, companies with robust governance mechanisms are less susceptible to corporate risk.

By analysing the relationship between CG and AR management in companies listed on the SCM, this research helps to address a gap in the literature. As Rehman et al. (2022) note, it is essential that the board of directors takes primary responsibility for AR management, since this can affect the company's performance value. Similarly, the sectoral classification of the results constitutes an additional contribution of the present study.

The main result of the analysis is that the level of AR for these companies depends on two control variables: size (SIZE) and whether or not they belong to the financial sector (FINANCE). It also depends on the percentage of proprietary directors (DOM), which relates to the company's governance structure. AR is directly related to the first two variables and inversely related to the third.

A company's size (SIZE) can affect its level of risk exposure, as those with greater economic resources have access to advanced technologies and broader and highly qualified human capital. This allows them to implement more effective risk management strategies, increasing their propensity for risk and facilitating investment in higher-risk assets.

Whether or not a company belongs to the financial sector (FINANCE) can affect risk due to the variable used to measure it, since risky assets carry more weight in financial companies, thereby affecting AR.

Proprietary directors (DOM) can influence risk due to their higher degree of risk aversion compared to other directors. This may be because Spanish investors have historically been risk averse (Andreu et al., 2012).

These results show that, at the cross-sectoral level, a significant proportion of the variability in AR is explained by control variables unrelated to CG (FINANCE, SIZE), while the remainder is determined by CG-related variables. This may be due to limitations of the study, particularly the fact that the sample only covers two periods, or that CG does not influence AR as measured by OAR. In any case, this justifies conducting a sectoral analysis aimed at reducing heterogeneity between sectors.

The results of the analysis, broken down by sector, reveal that size (SIZE) has a positive effect on AR in the basic materials, industry and construction (sector 2) and financial services (sector 5) sectors. This is because the greater the volume of investments made by this type of company, the greater the risk to which they are exposed. In sector 2, companies require large investments in infrastructure, machinery and raw materials, making it capital intensive. These investments tend to be costly, exposing companies to greater risks and market volatility. In sector 5, the business model is based on asset management and exposure to financial markets. The greater the volume of investments, the greater the exposure to credit, market and liquidity risks, as well as volatility in the financial markets.

A statistically significant relationship was found between AR and governance structure variables in the oil and energy (sector 1), basic materials, industry and construction (sector 2), and technology and telecommunications (sector 6) sectors. Notably, in sectors 1 and 6, the presence of blockholders (ADV) is inversely proportional to AR. This relationship suggests that greater control by these investors reduces uncertainty and improves financial stability, potentially affecting the insolvency process and ultimately the number of bankruptcies. Conversely, an inverse relationship was identified between AR and the presence of proprietary directors (DOM) in sector 2, suggesting that greater representation of these directors on the board strengthens supervision and reduces the associated risk. This result supports the hypothesis that strong CG contributes to risk mitigation in organisations, particularly in sectors with high volatility and capital requirements.

As Spanish investors are risk averse, the remuneration of board members and senior management (COM) may reduce AR (Andreu et al., 2012). The results obtained in the financial services sector (5) are consistent with this hypothesis.

Previous literature suggests that board members and senior management tend to guarantee their remuneration through lower-risk assets. It also suggests that the relationship between the two variables could be explained by the volume of investment in the sector, which is above that of other SCM sectors.

Finally, a positive and statistically significant relationship was found between AR and the frequency of board meetings (MEET) in sector 1. This can be explained by the argument that, in the face of increased volatility in energy markets and/or the raw materials used to produce energy (e.g. gas and oil), the frequency of board meetings may increase in order to manage the uncertainty of these markets. Therefore, a greater number of board meetings may be associated with a higher level of risk.

These results demonstrate that, once structural effects have been accounted for and intersectoral heterogeneity eliminated through sectoral analysis, variables related to CG account for a significant proportion of intra-sectoral variability. Specifically, the variables ADV, COM, DOM, and MEET show explanatory power in all sectors where it is possible to estimate a statistically significant model, thereby enhancing the predictive capacity of the models in all sectors except sector 6. Similarly, the results show that CG exhibits specific characteristics in each sector from both quantitative and qualitative perspectives, justifying segmentation and differentiated analysis by sector in future research.

From a practical standpoint, the findings of this study have important implications for CG design and risk management. For example, regulators may wish to promote governance structures that include proprietary directors, particularly in sectors with high capital intensity, given that their presence is associated with lower AR. Investors can use insights into firm size and sectoral affiliation to better assess portfolio risk exposure. However, corporate boards may benefit from tailoring their governance practices to the specific risk dynamics of their industry, rather than applying uniform governance codes.

This study has several limitations. First, the measurement of AR is based on financial proxies and may not capture other dimensions, such as operational and reputational risk. Second, the sample consists of data from 98 SCM companies over two years. On the one hand, a two-year period may be insufficient to capture the effects of those CG variables whose impact on AR manifests gradually over a longer period. On the other hand, it makes the multiple linear regression model the most appropriate for the envisaged

analysis and rules out the application of other models, for which obtaining stable and consistent estimates requires a greater range. Third, some sectors have a small number of observations, particularly sectors 5 and 7 (24 observations), sector 1 (16) and sector 6 (12). While this number is sufficient to identify structural relationships between variables within sectors, it has limitations. The calibrated models exclude several sectors (3, 4 and 7) due to a lack of statistical significance and/or moderate explanatory power, particularly in sectors characterised by high heterogeneity or a very small number of observations (1 and 6).

Future research should broaden the temporal and geographical scope, incorporate further risk metrics and examine the impact of ESG factors on the relationship between governance and risk.

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Supplementary material accompanies this paper.

Supplementary Data 1 – Database

Supplementary Data 2 – Codebook

Supplementary Data 3 – R Script

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