

Clustering Model to Classify Firms According to their Management and Risk Management Practices from a Financial Perspective Societies' Risk Control: A Financial Clustering model for Classification

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Abstract: Corporate governance practices for risk control and management are constituted as a self-regulation system at the organizational level in order to contribute to strategic, operational, and fulfillment objectives. The main research objective was to characterize companies depending on their degree of adoption for corporate governance practices with regards to their financial results during the 2020c-2022 triennium via classification algorithms. Our findings were that the level of adoption is still incipient for the subcategories under consideration, and that the overall data set was divided into three clearly defined groups, with significant differences in adoption level as well as financial performance.

Keywords: Corporate governance, financial performance, risk mitigation.

1. INTRODUCTION

Risk-based decision making within a corporate context is an everyday topic, making risk management a cutting-edge and integrated focus for managing the risks which corporations must face from the perspective of the system (Wu, Olson and Dolgui 2015).

There is currently a rise in regulatory pressure to adopt and implement risk management programs within companies (Ai, Bajtelsmit and Wang 2016). Corporate governance is thus closely linked with government policies and the legal requirements which guarantee financial prudence and stable performance (Li et al. 2020).

From this perspective, a link is created between corporate governance and risk which is grounded in the idea that regulation seeks to prevent excessive corporate risk or managers taking advantage (Balachandran and Faff 2015). The results also show that Enterprise risk management (ERM) is positively related with corporate performance and the adoption of these practices, since we can infer that the more effective ERM is in a company, the greater the capacity which the entity will have to achieve strategic objectives (Farhan, Zaman and Buckby 2019).

In Chile, government organizations have mainly developed laws and regulations which have laid the grounds for corporate governance within businesses, as influenced by political and economic events (Godoy, Walker and Zegers 2018). The last decade has seen a crisis of trust in various Latin Ameri-

can markets including Chile due to accounting scandals, including various corporate cases which the national private market has faced (Moraga and Roperio 2018).

This is why organizations have a need to minimize the uncertainty inherent to different types of risks, while also increasing corporate value by establishing strategies and objectives which seek a proper balance between growth, profitability, and the risks involved in their pursuit (Robles, Castañeda and Carrizo 2019). Enterprise risk management is also considered a strategic asset leading to competitive advantage (Parvaneh et al. 2019)

On these grounds, we can say that the connection between risk and corporate governance is one of the most significant connections explaining the relation between the latter element and optimizing corporate value (Balachandran and Faff 2015). Therefore, within the context of the ties between corporate governance, risk management, and financial performance, we can present the following question within the present study: What is the financial profile of Chilean corporations based upon the implementation or non-implementation of corporate governance related with risk control and management?

The present study is intended to financially characterize Chilean corporations based upon their implementation or non-implementation of corporate governance practices focused on risk control and management. We can thus contribute to the debate on the relation between financial performance and risk management from a profile construction perspective, which contributes to comprehension regarding the financial characteristics of enterprises and whether or not they implement this type of practice.

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2. CONCEPTUAL FRAMEWORK

Corporate governance is a system which regulates and balances power relations between shareholders, executives, and the board in order to increase trust between interested parties and improve economic results, while maximizing corporate value (Morck 2014). It consists of a set of rules, practices, and procedures regulating the relations within an organization (Maya 2011). The objective of corporate governance is to facilitate the creation of an environment with trust, transparency, and accountability, all of which are needed to favor long-term investments, financial stability, and business integrity (OCDE 2016). Good corporate governance also considers power relations and best practices, which is why companies with good corporate governance see their financial earnings rise along with their value for shareholders, administrators, interest groups, and society (Acosta 2018).

It is also expected that proprietors can benefit from the adoption and implementation of corporate governance practices by using principles and mechanisms equivalent to effective corporate activity monitoring, especially when applying disclosure and transparency principles (Grantham 2020).

The concept of risk management goes back centuries, but is a recent trend in business. With the rise of internal control during the 1990s, it has taken on an important role which enterprises must reinforce (Brito 2018). To understand this, we must consider that risk management is an iterative process which must be an integral part of decision-making management within any entity, composed of a set of coordinated activities to direct and control the organization with regards to risk (ISO 31000, 2018).

Risk management also increases the agility and strength of the decision-making process, since by identifying and mitigating risks it improves organizational credibility, increasing its stability and competitiveness, helps improve its corporate image, and diminishes possible legal liabilities (Valencia-Jara and Narváez-Zurita 2021).

In Chile, the first attempt focused on self-regulation and corporate governance disclosures was via NCG #341, which showed a broad range of responses from businesses. The item for risk management and control showed a significant divergence between different enterprises, some of which considered it a necessary practice while others disagreed, which continued during its time in effect (Godoy et al. 2018). Subsequently, the adoption level for corporate governance practices among Chilean companies regarding this category, according to NCG #385 during the period 2015 – 2016 for its three subcategories, was below 50%, and in 2017 two of them reached 50% adoption (Arenas, Campos and Santander 2019).

3. LITERATURE REVIEW

Existing literature approaches the adoption of risk management practices in corporate governance with regards to financial performance from various perspectives. However, within the scope of the review no studies were found which carried out a characterization of the companies from their own financial results. Instead, the topic has been mainly addressed from the relation and incidence of corporate governance practices' adoption according to NCG #385 overall and

financial performance as measured via various profitability and solvency indicators, or how the latter points influence these practices' disclosure.

Moraga and Rossi (2019), by analyzing responses to questionnaire NCG #385, examine and determine the characteristics of the companies which have adopted corporate governance practices in Chile at large, and establish whether this adoption affects the financial solvency of the companies under review as measured via the Z-score model from Altman (1968). To this end, 198 companies were considered, all of whom had shares available in the Chilean stock market and responded to our questionnaire during the year 2016.

Authors including Arenas-Torres, Bustamante-Ubilla and Campos-Troncoso (2021), carried out a descriptive correlational study via descriptive statistics followed by multiple regressions in order to determine whether the adoption of corporate governance practices had a positive and significant impact on Chilean enterprises' profitability, where the third category was focused on practices related with risk control and management. The study considered 903 reports from 177 companies regulated by the FMC, who reported their practices in line with NCG #385 between the years 2015 and 2019.

Moraga and Roper (2018) also analyzed the degree of adoption and homogeneity for corporate governance practices among enterprises in the IPSA market, and whether this adoption affected financial performance variables including the ROE and Tobin's Q. They used a descriptive study and applied both the variation coefficient and non-parametric tests, including Kruskal Wallis and Spearman's Rho. Adoption level was also measured with the IACGEx indicator. It should be noted that the study considered the information from 35 IPSA member companies and 124 non-IPSA member companies which reported their practices in line with NCG #385.

Agustina and Baroroh (2016) used descriptive analysis, linear regression and route analysis to consider the influence of Enterprise risk management on the value of companies as measured via their financial performance. To this end, they used data from 30 banking companies which were all listed on the Indonesian stock market, with a total of 53 reports between 2011-2013.

Horvey and Ankamah (2020) used a panel regression analysis composed of 30 companies listed on the Ghanaian Stock Market between 2010 and 2016 in order to analyze the linear or non-linear relation between ERM, as measured via the Enterprise Risk Management Index (ERMI) and the companies' performance as quantified via ROE, ROA and Tobin's Q.

Prior literature indicates the range of studies carried out regarding the adoption of corporate governance practices, risk management, and corporate financial performance. The topic has mainly been approached from the perspective of the relation between the variables by applying regressions and non-parametric tests.

Our contribution lies in the financial characterization of Chilean companies implementing a risk management framework based upon their financial results, which will, for one thing, let us know the current level of adoption for these

Table 1. Description of practical risk management variables and financial indicators.

Variable	Abbreviation	Operation by Company
Formal risk control and management process	VAR 1	<u>Summation of practices adopted</u> 9 practices
Formal whistleblowing procedure	VAR 2	<u>Summation of practices adopted</u> 4 practices
Formal procedure to “Identify barriers, diverse abilities and succession chains”	VAR 3	<u>Summation of practices adopted</u> 5 practices
Formal procedure “Salary structures and compensation/indemnity processes for senior executives”	VAR 4	<u>Summation of practices adopted</u> 4 practices
Return on equity (discounting gains or losses) (%)	ROE	Gains (losses) *100 Total patrimony - Gains (losses)
Return on assets (%)	ROA	<u>Gains (losses)</u> *100 Total assets
Net working capital (thousands of monetary units)	CT	(Total current assets – Total current liabilities) / 1000
Debt ratio	RE	<u>Total liabilities</u> Total patrimony

practices, but will mainly let us visualize the companies’ grouping based upon their level of adoption for these practices from a financial perspective. In this sense, unlike prior studies which have focused on the overall set of practices, our attention is centered on the constituent subcategories in the risk control and management dimension, according to NCG #385 and the financial results of each company involved in the study.

The rest of the article is organized as follows: section 2 describes the methodology used in the study. Section 3 discusses the results. Finally, the analysis and conclusions based upon the results are in section 4.

4. METHODOLOGY

The present study has a quantitative longitudinal design with a descriptive focus, based upon secondary data compilation, which was gathered from the public database in the Financial Market Commission (FMC), specifically the item on corporate governance practices for each enterprise (CMF, 2023).

The study population is composed of 105 companies from the year 2022, 99 for 2021, and 97 for the year 2020. Every enterprise in the study is an open joint stock corporation, registered on the list of fiscal entities scrutinized by the FMC and which to date have continued to respond to the questionnaire in NCG #385, which obligates companies to reveal their corporate governance practices so that investors have sufficient information for informed decision-making. This electronic form is sent to the FMC via the SEIL module on the commission website no later than 31 March of each year, and is composed of 99 practices. However, for the present study only 22 were considered, corresponding to the category for risk control and management within the regulations.

The questionnaire responses are all dichotomous, responding “YES” if the enterprise has adopted the practice and “NO” if the company does not apply the practice or is still currently implementing it. For data analysis effects, Yes = 1 and No = 0.

To determine the adoption level for corporate governance practices regarding risk control and management within each company, we referred to Arena-Torres et al. (2021), where the degree of adoption in this category was calculated as the

sum of practices adopted by each enterprise divided by the 22 constituent practices. By contrast, in our study this was done for each of the constituent subcategories. In the case of the financial indicators under the IFRS standard, the calculation formula for each one can be found according to the operation used by the Financial Commission market, taken directly from their website.

The first Subcategory refers to a formal risk management and control process, which approaches the risk management policies approved by the directors, having a risk management unit and an internal auditing unit or an equivalent which is responsible for verifying the effectiveness and fulfillment of the internal norms approved by the directors. The risk management process also incorporates both direct risks to the business and indirect risks which can arise from the enterprises belonging to the corporate group, along with considering the potential impact of the materialization of socio-economic and environmental sustainability risks. Various national and international recommendations and principles are considered as guides, including COSO, COBIT, ISACA, ISO 31000:2009 and ISO 31004:2013. An ethical code or its equivalent is also considered, along with whether or not it faces an annual review, and whether it includes the ongoing training and instruction of all relevant personnel regardless of contractual bonds with the enterprise, with regards to policies, procedures, controls and codes of conduct implemented for risk management.

The second subcategory is related with the implementation of a formal procedure to channel complaints arising from the interested parties, guaranteeing anonymity to the whistleblower as well as allowing them to know about the status of their complaint, as well as whether this channel is made available to personnel, shareholders, clients, suppliers, and third parties.

The third subcategory refers to the formal procedure which allows for detecting and reducing organizational, social, and cultural barriers which may impede the full diversity of capacities, conditions, experiences, and visions, identifying the elements which their main executives must have, and helping to identify potential replacements for senior management positions among employees and other potential substitute

executives, in order to pass along their functions and relevant information in case of absences.

The fourth refers to a formal operational procedure related with salary structure and policies for senior corporate executives' compensation and indemnities on an annual basis, in order to detect or correct eventual incentives exposing the society to risks which are not aligned with the policies defined for the matter, or to the eventual commission of criminal acts. Another point considered is whether there is any disposition for third-party advisors or consultants to support this review, and if there are considerations for spreading this information on the corporate website. The last point considered is whether these salary structures and policies undergo shareholder approval.

4.1. Analysis Techniques

Before applying clustering techniques, the integrity and coherence of the data is checked. Both missing and corrupted values (values not consistent with variable definitions) are identified. The dataset is then coded for both statistical and clustering analysis, after which variable scaling and a PCA (Principal Component Analysis) are applied. PCA is considered for finding an underlining pattern when data is projected in a low dimensional space (Jolliffe and Cadima 2016). Next, a descriptive analysis is performed to summarize the data.

In order to classify firms according to risk accomplishment level, three clustering models are considered: K-means, Gaussian Mixture and Spectral Clustering. Clustering models have proved to be adequate for classification tasks (Saxena et al. 2017). Reviews tackling the uses of this sort of model in domains related to both finance and management include Sadeghi, Safari and Yousefi (2021) and Ghosal et al. (2020).

K-means is a classic clustering algorithm introduced by Lloyd (1982). With a given collection of data points $(\mathbf{X}_1, \mathbf{X}_2, \dots, \mathbf{X}_n)$, where each data point is a d-dimensional real vector, k-means clustering divides the n data points into $k \leq n$ clusters $\mathbf{C} = \mathbf{C}_1, \mathbf{C}_2, \dots, \mathbf{C}_k$ in a way that minimizes the total sum of squares within each group (WCSS). Equation 1 mathematically expresses the goal of K-means.

$$\arg \min_{\mathbf{C}} \sum_{i=1}^k \sum_{\mathbf{X} \in \mathbf{C}_i} \|\mathbf{X} - \boldsymbol{\mu}_i\|^2 \quad (1)$$

Where $\boldsymbol{\mu}_i$ is the centroid of cluster i , which is computed according to Equation 2.

$$\boldsymbol{\mu}_i = \frac{1}{|\mathbf{C}_i|} \sum_{\mathbf{X} \in \mathbf{C}_i} \mathbf{X} \quad (2)$$

Gaussian Mixtures models are parametric clustering approaches, assuming that a mixture of finite Gaussian distributions generates the data (Garcia-Dias et al. 2020). This approach considers K different clusters in the data, where each cluster k is drawn from a Gaussian distribution G so that the probability $p(\mathbf{X})$ that a data point \mathbf{X} belongs to a specific cluster k is given by

$$p(\mathbf{X}) = \sum_{k=1}^K \pi_k G(\mathbf{X}|\boldsymbol{\mu}_k, \boldsymbol{\Sigma}_k) \quad (3)$$

where π_k is a mixing coefficient which weights the k^{th} distribution ($\sum_{k=1}^K \pi_k = 1$), $\boldsymbol{\mu}_k$ is the mean of the k^{th} distribution, and $\boldsymbol{\Sigma}_k$ is the covariance matrix associated to the k^{th} distribution.

Spectral clustering is an approach based on the construction of a similarity graph ζ (where nodes are data points and edge weights represent similarity), from which the eigenvectors of the corresponding Laplacian matrix $\mathbf{L} = \mathbf{D} - \mathbf{A}$ are employed to identify data clusters (Von Luxburg 2007). Here, \mathbf{D} and \mathbf{A} are the corresponding degree and adjacency matrices of ζ , respectively. In addition, ζ is a fully connected graph where the similarity weight between data points \mathbf{X}_i and \mathbf{X}_j is given by

$$\omega_{ij} = \exp\left(-\frac{\|\mathbf{X}_i - \mathbf{X}_j\|^2}{2\sigma^2}\right) \quad (4)$$

where σ is the neighborhoods' dispersion. Note that Equation (4) can be regarded as a Gaussian kernel applied on the Euclidean distance between points \mathbf{X}_i and \mathbf{X}_j (Hongjie et al. 2014). According to Shi and Malik (2000), an advantage of spectral clustering over other clustering approaches is its ability to globally optimize the clusters.

Each of the clustering approaches considered in this work needs the number of clusters K as an input parameter. For this reason, the elbow method described by Cui (2020) is applied beforehand to determine K.

The Sklearn and Pandas Python libraries both implement all data pre-processing as well as the clustering algorithms. The number of clusters and random states equal to 1 are the input parameters equally defined for both the K-means and Gaussian mixture algorithms, whereas cluster number, affinity = "nearest neighbors" and random state = 1 are input parameters for the spectral clustering method.

5. RESULTS

5.1. Dataset Summary

Table 2 summarizes the data associated with the VAR variables. Since such variables represent percentages, they are already normalized. It is noticed that mean and standard deviation show a similar behavior throughout the years. We can observe that only the whistleblower channel procedure reached 56% adoption in 2022, and the other three categories are at or below a 50% average, highlighting how the practices related with salary structure approval have remained static at 18% over the last three years.

Table 2. Summary statistics for years 2020-2022.

Year	2020		2021		2022	
	Mean	Std	Mean	Std	Mean	Std
-						
VAR1	0.431	0.402	0.423	0.394	0.433	0.409
VAR2	0.546	0.454	0.479	0.393	0.562	0.456
VAR3	0.258	0.358	0.283	0.377	0.276	0.367
VAR4	0.186	0.240	0.187	0.240	0.186	0.245

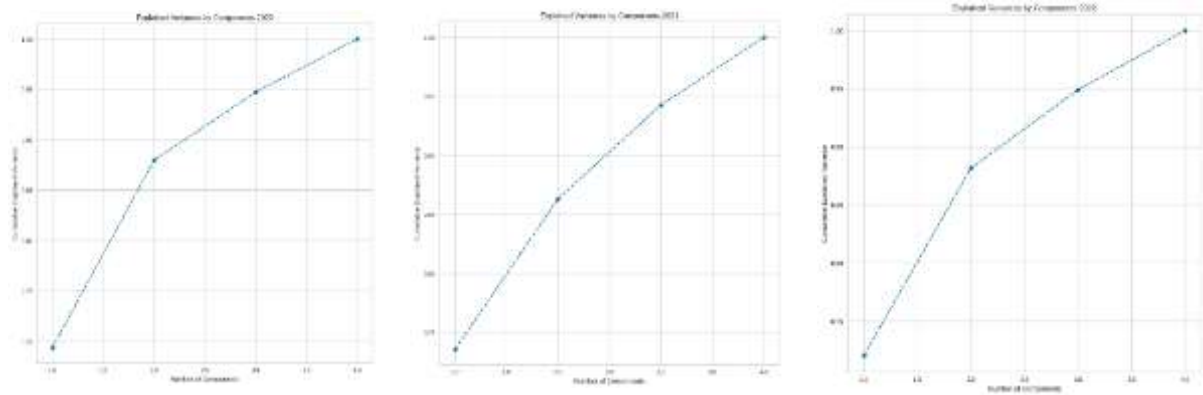


Fig. (1). PCA analysis for VAR components 2020-2022.

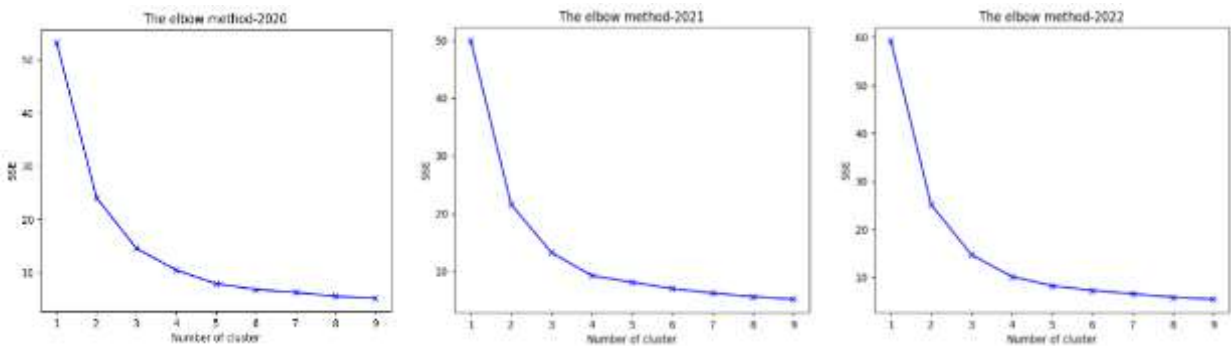


Fig. (2). Elbow method applied on data from 2020 to 2022. Results confirm K=3 as the adequate number of clusters.

Table 3 summarizes the results of the financial indicators for profitability, solvency, and indebtedness. We can observe that debt levels for the studied companies are above 1, *i.e.*, they have more debts than assets. In turn, return on patrimony is greater than income on assets during the three years, and the average working capital is positive.

Table 3. Financial summary statistics 2020-2022.

Year	stat	ROE	ROA	CT (USD)	RE
2020	mean	0.00656	0.000153	41472.26	1.073
	std	0.00276	0.001619	153663.69	1.739
2021	mean	0.25441	0.079307	23523.25	1.036
	std	1.11176	0.164889	59356.41	1.098
2022	mean	0.12188	0.059714	188862.25	1.066
	std	0.23939	0.144596	73213.04	1.124

Fig. (1) shows results for the PCA analysis. It is notable that three VAR components explain over 90% of the variance in each year. This information is mainly used to subsequently project the data to a lower dimensional space and display clusters by labeling the corresponding data points.

5.2. Model Results

Fig. (2) shows results for the elbow method (SSE stands for Standard Square root Error). The plots support K=3 as

a proper input parameter for the K-means model. For the sake of comparison, K=3 is also set as an input parameter for the Gaussian mixture as well as the spectral clustering model.

Table 4 depicts the percentage of firms in each cluster according to each applied model. Cluster distribution remains quite even across years, where Cluster A groups most of the firms.

Table 4. Cluster distribution according to clustering model.

Cluster Distribution (%)				
Year	Cluster	K-means	Gaussian Mixture	Spectral Cluster
2020	A	43.3	48.5	46.4
	B	37.1	34.0	36.1
	C	19.6	17.5	17.5
2021	A	40.4	45.5	43.4
	B	38.4	34.3	36.4
	C	21.2	20.2	20.2
2022	A	40.9	44.8	42.9
	B	38.1	35.2	37.1
	C	21.0	20.0	20.0

Table 5. Cluster description -2020.

-	K-means			Gaussian Mixture			Spectral Cluster		
	Cluster_A	Cluster_B	Cluster_C	Cluster_A	Cluster_B	Cluster_C	Cluster_A	Cluster_B	Cluster_C
VARI	0.552910	0.049383	0.883041	0.534279	0.037037	0.908497	0.548148	0.047619	0.908497
VAR2	0.875000	0.020833	0.815789	0.840426	0.000000	0.794118	0.872222	0.007143	0.794118
VAR3	0.161905	0.022222	0.915789	0.187234	0.000000	0.952941	0.182222	0.017143	0.952941
VAR4	0.184524	0.034722	0.473684	0.186170	0.030303	0.485294	0.188889	0.035714	0.485294
ROE	0.000408	0.000412	0.001665	0.000437	0.000433	0.001693	0.000444	0.000425	0.001693
ROA	0.000183	-0.000025	0.000425	0.000211	-0.000047	0.000381	0.000206	-0.000026	0.000381
CT(USD)	70348.84	11057.991	35266.89	66840.04	10970.385	30547.37	69552.18	10675.906	30547.37
RE (times)	1.028298	1.0131220	1.286579	0.980066	1.052245	1.371688	0.991958	1.0328310	1.371688

Table 6. Cluster description -2021.

-	K-means			Gaussian Mixture			Spectral Cluster		
	Cluster_A	Cluster_B	Cluster_C	Cluster_A	Cluster_B	Cluster_C	Cluster_A	Cluster_B	Cluster_C
VARI	0.544444	0.043860	0.878307	0.529716	0.046296	0.872222	0.529716	0.046296	0.872222
VAR2	0.700000	0.042105	0.847619	0.697674	0.011111	0.850000	0.697674	0.011111	0.850000
VAR3	0.200000	0.013158	0.928571	0.197674	0.013889	0.950000	0.197674	0.013889	0.950000
VAR4	0.200000	0.026316	0.452381	0.191860	0.027778	0.462500	0.191860	0.027778	0.462500
ROE	0.140165	0.102341	0.747172	0.137365	0.098498	0.786676	0.137365	0.098498	0.786676
ROA	0.060345	0.107172	0.065001	0.058074	0.110149	0.069441	0.058074	0.110149	0.069441
CT(USD)	29601.00	22972.92	12942.41	28346.17	23285.96	13581.06	28346.17	23285.96	13581.06
RE (times)	1.031583	0.698155	1.653738	1.071026	0.628380	1.692295	1.071026	0.628380	1.692295

Table 7. Cluster description 2022.

-	K-means			Gaussian Mixture			Spectral Cluster		
	Cluster_A	Cluster_B	Cluster_C	Cluster_A	Cluster_B	Cluster_C	Cluster_A	Cluster_B	Cluster_C
VARI	0.545220	0.050000	0.909091	0.522459	0.039039	0.925926	0.535802	0.048433	0.925926
VAR2	0.889535	0.031250	0.886364	0.861702	0.000000	0.880952	0.883333	0.019231	0.880952
VAR3	0.176744	0.025000	0.927273	0.187234	0.010811	0.942857	0.186667	0.020513	0.942857
VAR4	0.191860	0.025000	0.465909	0.191489	0.020270	0.464286	0.194444	0.025641	0.464286
ROE	0.118941	0.131986	0.109229	0.121926	0.130200	0.107095	0.118619	0.133591	0.107095
ROA	0.042206	0.082278	0.052909	0.044988	0.083228	0.051243	0.043056	0.083495	0.051243
CT(USD)	26674.36	22519.59	-3056.54	27886.15	21639.71	-6227.69	27563.16	22332.72	-6227.69
RE (times)	1.283056	0.527419	1.624136	1.236677	0.504402	1.676786	1.256762	0.518778	1.676786

Tables 5, 6 and 7 describes cluster composition for each year according to averages of both risk variables and financial features. Noticeably, cluster structure remains fairly similar throughout the years.

To visualize cluster distribution, data points are projected into a lower two-dimensional space which is constructed by a PCA analysis. Fig. (3) shows cluster distribution for

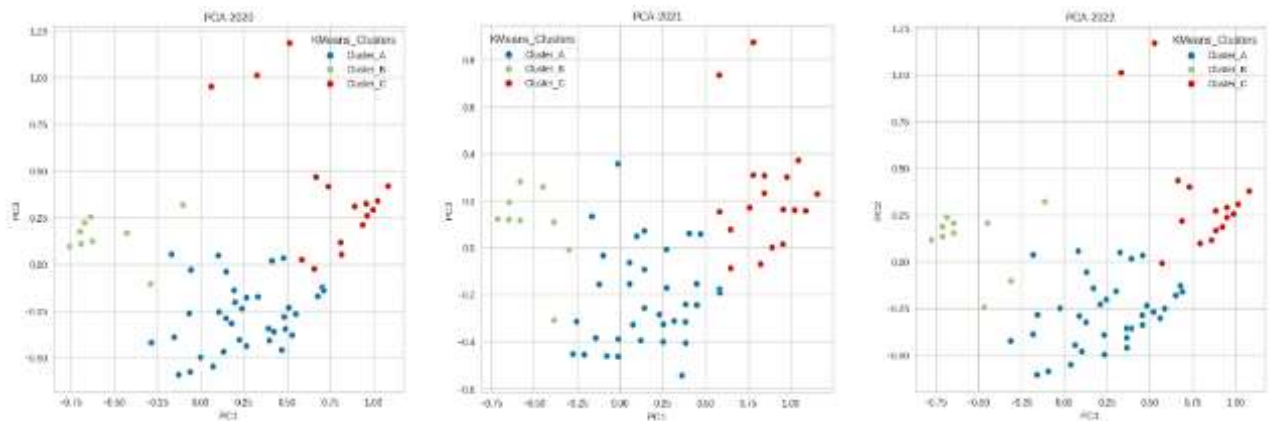


Fig. (3). Data projection based on the first two principal components associated to risk level variables. K-means clusters are displayed in colors.

2020-2022. The K-means model has been selected to show

distribution, since the results feature a similar behavior throughout both years and clustering approaches. Projected clusters show low distortion and overlapping looks minimized for every year.

6. DISCUSSION

In general, the adoption level for corporate risk control and management governance practices is at an early stage. These results align with Arenas-Torres et al. (2021), who concluded that adherence to these practices is still incipient and that the advances have been marginal after 5 years of NCG #385 being entirely in force.

We also saw evidence that the whistleblowing procedure channel is the only practice with more than 50% adoption during the 3 years under study. By contrast, the other three subcategories were at or below 50% adoption on average. These results mesh with Arenas et al. (2019), who indicated that one of the most developed principles was the implementation of whistleblowing channels at 63% implementation in 2017, while the other three subcategories remained at or below 50% adoption in the same year.

With regards to the set of groups, Cluster C is composed of companies with the highest level of adoption for risk management practices and the greatest ROE during the period 2020 – 2021 but lower in 2022. In the case of the ROA, this figure is lower between 2021 -2022 compared with the other two groups. In this sense, Horvey and Ankamah (2020) suggest that the relation between ERM and corporate performance is not monotonous, indicating the existence of a non-linear relation between both, given that their results indicated the effect of the ERM coefficient value in its initial stages increases ROE, but that this decreases as ERM advances. By contrast, ROA reduces performance in early stages and has positive effects as it increases.

These enterprises also present higher debt levels compared with the other two groups, and their working capital fell drastically and progressively over the period 2020 – 2022; during the last part, it even went into negative numbers.

The group of companies with the highest adoption level are also the most profitable. This fits with the findings from Florio and Leoni (2017) showing that companies with more sophisticated ERM systems are more profitable and better rated by financial markets. By contrast, enterprises with rudimentary or non-existent ERM systems are less profitable and less esteemed by investors; i.e., incomplete adoption of ERM components will not have a significant effect on corporate performance.

This contrast is reflected in Cluster B, including the corporations with the lowest level of adoption for the risk control and management practices compared with the other two groups, which is maintained across 2020 and 2021. Similarly, their financial performance as measured by ROE and ROA is lower compared with the other two groups in both years. However, there are also lower debt levels, and 2022 saw better financial performance along with intermediate working capital.

Cluster A includes businesses with a medium level of adoption for corporate governance practices regarding risk control and management. These enterprises have a significantly greater working capital than the other cluster groups, with profitability on patrimony and assets and an intermediate debt ratio.

By contrast with this situation, authors such as Moraga and Rossi (2019) indicate that there is no significant positive impact from the level of adoption for CG practices upon Chilean companies' profitability. Moraga and Roper (2018) also agreed that there was no relation between a higher degree of adoption for corporate governance practices and better financial performance. More specifically, Agustina and Baroroh (2016) indicated that ERM implementation did not significantly influence corporate profitability.

CONCLUSION

The study goal was to financially characterize Chilean companies, based on their level of adoption for corporate risk control and management practices. To this end, we applied various clustering classification techniques to characterize Chilean enterprises during the 2020-2022 triennium.

Risk control and management practices are increasingly relevant at the regulatory and business levels, given their incidence in fulfilling organizational objectives, business transparency, and connections with financial performance. The contributions of the presents study are related with updating the degree of adoption for these practices, which are still in an early stage of adherence among Chilean businesses. We can thus open the door to seeking mechanisms to incentivize the adoption and dissemination of the various mechanisms which constitute the framework for risk control and management in a company.

The businesses with the highest adoption of these practices had better financial performance, meaning that they can also provide a vision in this regard for future investors who consider the creation of a risk management framework to be a key decision-making factor.

The present study has some limitations which justify future research, given that the study was limited to inspected companies which continually reported their corporate governance practices as per the indications in NCG #385, making the study population rather limited. It should be mentioned that the regulation was overruled by NCG #461, which includes information about the topic directly within companies' records. It would thus be interesting to approach the changes, impact, and continuity of the topics carried over from the previous regulation.

From a theoretical perspective, future studies could be tied with the theory of agency to understand the relation between economic resource holders (principal) and a third party (agent), to which the owners ultimately delegate responsibility and managerial functions to be carried out in their name (Evana et al. 2023). This can be justified because the creation, implementation, and follow-up for a management framework is mainly the corporate directors' responsibility.

Finally, there is a heterogeneous range of studies and results regarding alignment with corporate governance practices in general, particularly regarding corporate risk management and financial performance.

LIST OF ABBREVIATIONS

CG	= Corporate Governance
COBIT	= Control Objectives for Information and Related Technology
COSO	= Committee of Sponsoring Organizations of the Tradeway Commission
CT	= Working Capital
ERM	= Enterprise Risk Management
ERMI	= Enterprise Risk Management Index
FMC	= Financial Market Commission
IFRS	= International Financial Reporting Standards
IPSA	= Índice de Precios Selectivo de Acciones
ISACA	= Information Systems Audit and Control Association
ISO	= Internacional Organization for Standardization

NCG	= Norma de Carácter General
PCA	= Principal Component Analysis
RE	= Debt ratio
ROA	= Return on Assets
ROE	= Return on Equity
SEIL	= Sistema de Envío de Información en Línea (Online Information Dispatch System)

CONFLICT OF INTEREST

The authors reported no potential conflict of interest.

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