



## Review Article

## Corporate social responsibility and financial profile of Spanish private hospitals

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## ABSTRACT

In the context of the recent economic crisis, the financial situation of the Spanish health sector has become a major concern for responsible actors from the public and private spheres, because of a decline in public spending and increased demand due to population growth and ageing. The public health system seeks collaborative synergies with the private health system to achieve better health care results, cut waiting lists and cope with financial pressure. The private health sector currently owns 452 hospitals in Spain (57% of the country's total). This paper analyses the financial statements of hospital companies in the Spanish private healthcare system, using compositional data (CoDa) methodology. It identifies a significant relationship between financial statement structure and corporate social responsibility (CSR). Relevant CSR indicators include a sustainability report according to the Global Reporting Initiative (GRI), accreditation by the Joint Commission International (JCI) and ISO 14001, 50001 and 26000 accreditations. These indicators reduce asset turnover and increase debt quality: the proportion of long-term debt within total liability. From a methodological perspective, the paper proposes the first application CoDa in statistical models to predict financial statements from non-financial variables, and the first use of CoDa in partial-least-squares structural equation models (PLS-SEM). Our methodological approach reduces the asymmetry, redundancy and outliers encountered in standard statistical models that predict financial ratios.

## 1. Introduction

In the current context, the financial situation of the Spanish health sector is a concern for all those responsible for public and private health institutions, due to budget cuts and the increasing demand for services resulting from population growth and ageing.

The public health sector is characterized by having limited resources, an incessant increase in spending and in care needs (population aging, increase in chronic diseases, etc.) that causes endless waiting lists. All these factors put pressure on health authorities and hospital managers, service managers and professionals to use these resources more efficiently.

The public health system seeks to collaborate and create synergies with the private health system to improve health care outcomes, cut waiting lists and cope with financial pressure. A report by the [Institute for the Development and Integration of Health \(IDIS, 2017\)](#) states that the private health sector decongests the public system and is a strategic

collaborator, which currently has 452 hospitals in Spain (57% of the country's total).

When evaluating the performance of hospitals, there are many institutions that do not have the traditional annual reports or the parameters and ratios that derive from them. In addition, to evaluate the activity carried out in the services of a hospital requires creating a customized management model and, therefore, discarding some of the models from for-profit companies ([Sánchez et al., 2009](#)).

The first objective of this study is to analyse the financial statements of hospital companies in the private health system. The research focuses on relevant financial indicators that health companies must control to survive and to provide a correct service to society. It also centres on non-financial variables, which together with financial variables contribute to improving the profitability of these institutions. Specifically, the study identifies a significant relationship between financial statements and non-financial indicators of corporate social responsibility (CSR).

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The second objective is to illustrate the usefulness of the compositional data (CoDa) methodology for relating financial and non-financial indicators. This methodological approach reduces the asymmetry, redundancy and outliers found in the analysis of standard financial ratios (Creixans-Tenas et al., 2019; Linares-Mustarós et al., 2018; Carreras-Simó and Coenders, 2019, in press). This is the first scholarly paper to use CoDa to predict financial statement structure from non-financial variables, the first to use pairwise log-ratios (Greenacre, 2019) in finance, and the first to combine structural equation models with CoDa (Kogovšek et al., 2013) using the partial least squares estimator (PLS-SEM).

The methodology used in the investigation, consists of the following steps: 1) identifying the relevant CSR indicators, 2) identifying the relevant financial indicators, 3) coding the presence of CSR indicators from the institutional web pages, 4) reframing the financial indicators as CoDa, 5) exploratory data analysis, and 6) data modelling with PLS-SEM.

After a review of relevant academic literature and a justification of the indicators, this article presents a PLS-SEM for identifying key relationships between CSR and financial indicators, which could be considered in the agendas of private hospital institutions.

## 2. Main text

### 2.1. Literature review

Several authors analyse the financial and economic situation of hospitals by studying their profitability (Turner et al., 2015; Lee, 2015). They affirm that the financial viability of long-term objectives requires that organizations generate positive returns on capital (ROE) and on assets (ROA). Thus, a more transparent and higher quality analysis of profitability will allow hospitals to meet the challenges of the future and the analysis of their financial statements is the first step.

Thus, in order to make decisions in hospital settings, both the financial and non-financial information of the annual reports must be known, since the health field not only responds to financial issues (Bem et al., 2014).

Hospitals, as institutions that play an important role in the health system, can make more profits by integrating social, economic and environmental issues into health care and health promotion (Weisz et al., 2011). Environmental sustainability can be achieved in hospital companies by promoting an evaluation of consumption patterns and changes in these patterns; it is especially necessary to embrace renewable ideas to reduce pollution and the use of fossil fuels, adopt conservation policies and replace non-renewable products with renewable ones (Gimenez and Tachizawa, 2012; Perera and Peiró, 2012).

In recent years, public interest in entities' transparency has increased considerably in the area of CSR. CSR information can be disseminated through websites (Nevado-Gil and Gallardo-Vázquez, 2016). In general, organizations worldwide now provide more information on issues related to their economic, social and environmental behaviour (Frías-Aceituno et al., 2013). Entities must comply with certain commitments that are directly related to their social responsibility towards stakeholders and society.

Hospital companies can benefit from embracing CSR (Khalaf et al., 2016). In addition to aiming for quality services, advanced technology and balanced prices, they must earn the respect of users, professionals and society (Nascimento et al., 2017). In the hospital sector, social and environmental impact is of great importance (Jarousse, 2012) in terms of material and energy consumption (Weisz et al., 2011). Hence, hospital institutions must integrate social, economic and environmental aspects into health care and its promotion (Weisz et al., 2011). As hospitals are responsible organizations, they must consider the economic, social and environmental dimensions of CSR (Rodríguez et al., 2017; Rodríguez-Cala et al., 2015). Some authors, such as Creixans-Tenas and Arimany-Serrat (2018), define CSR tools as non-financial indicators and

indicate that studies of hospitals that analyse non-financial information as well as financial indicators provide more added value to the correct diagnosis of economic and financial health. CSR must be aligned with hospital companies' strategy and objectives and balance financial, environmental and social aspects (Lemme, 2010; Marrewijk, 2003). For this purpose, tools, mechanisms or indicators must be used to measure and assess CSR, so that appropriate decisions can be made. The globalization of CSR requires the use of transferable indicators, which make international comparison possible (Sotelo et al., 2011). CSR indicators should reflect the dimensions of the triple bottom line (Nascimento et al., 2017; Singh et al., 2011) to communicate and permeate this policy of action. In this study, we use the most widely recognized CSR indicators in the academic literature, including: the publication of reports or sustainability reports, the presence of accreditations and quality seals and standards and certifications (Nascimento et al., 2017).

### 2.2. Corporate social responsibility: non-financial indicators

#### 2.2.1. The sustainability report

The sustainability report is designed to systematize and disseminate quantitative and qualitative information on sustainable business issues, encourage participation and provide transparency for all stakeholders. The most commonly used sustainability report model is that proposed by the Global Reporting Initiative (GRI). The GRI is a non-profit organization founded in 1997 that publishes a voluntary guide for preparing sustainability reports or non-financial reports, considering economic, social and environmental aspects. The guide's main characteristics are global applicability and comparability. The guide provides an extensive number of indicators and is used by thousands of public and private institutions worldwide as it focuses on internationalization of social norms, public information and transparency (Moyano and Rivera, 2017). The latest version of the guide, called G4, stands out for its environmental content and includes a detailed description of possible indicators to measure CSR, with four principles to determine the issues that organizations must report: materiality, stakeholder participation, the context of sustainability and comprehensiveness (GRI, 2015). Nascimento et al. (2017) indicate that hospitals that publish sustainability reports are more advanced in sustainability practices than those that do not.

#### 2.2.2. Accreditations and quality seals

Accreditations are related to a hospital's ability to follow best practices in care and administrative management using quality management tools. Hospital accreditations show that a hospital operates according to practices previously defined by international or national bodies, which guarantee patient safety and good care outcomes and recognize the clinical experience of units, the capacity to investigate, exchange information and network or prepare professionals and facilities (Satorras, 2002). Quality seals are distinctions that demonstrate the quality of hospital activities. They are becoming very useful instruments for patients to trust in a good service. To gain a quality seal, hospitals must be audited by specialized companies, to verify that the established requirements are met (Mayer et al., 2009).

##### 2.2.2.1. Typology of accreditations and quality seals. The best-known accreditations and quality seals include (Satorras, 2002):

1. The European Foundation for Quality Management Model (EFQM) is a quality assessment system based on the analysis and evaluation of key results and economic and non-economic organization, as well as results referring to customers, staff and society. The main criteria in the EFQM model are focused on results, leadership and coherence, the development and involvement of people and the organisation's social responsibility, among others. In short, the EFQM is based on achieving the satisfaction of customers and employees and a positive impact on society through leadership in policy and strategy,

management of the right staff, efficient use of resources and an adequate definition of processes, which ultimately leads to excellence in business results (Vernero et al., 2007).

2. Accreditation by the Joint Commission International (JCI). The JCI is an independent organization that administers and evaluates surveys of international, national and other health organizations to determine whether they meet international quality standards. This entity has created a unique set of international standards by which health systems are measured and which consider the safety and quality of hospital care. Hence, when a hospital applies to be accredited by JCI, it seeks to ensure that its level of hospital care meets accepted international standards (Yousefian et al., 2013).

### 2.2.3. Standards and certifications

Certification of a hospital institution is the process by which a hospital is voluntarily incorporated into an external verification of compliance with a set of previously established standards, through an accrediting body that issues a verdict through a certificate (Satorras, 2002). Organizations have different management system standards to meet their needs and those of stakeholders (Conesa et al., 2016; Simon et al., 2012). In particular, certifications issued by the International Organization for Standardization (ISO) are widely used in the health system.

The families of ISO 9000 and ISO 14000 standards are among the best-known. The ISO 9000 family addresses quality management, while the ISO 14000 family deals with environmental management. In absolute terms, certification in the ISO 9000 family standards is five times more common than certification in ISO 14000 standards. Other management systems have proliferated, such as occupational health and safety (OHSAS, 18001, ISO 45001), energy management (ISO 50001) and social responsibility (ISO 26000) (Conesa et al., 2016; Simon et al., 2012).

**2.2.3.1. The most relevant standards affecting the hospital sector.** According to several authors (Moyano and Rivera, 2017; Nascimento et al., 2017; Conesa et al., 2016; Heras and Arana, 2011), the five most relevant standards in the hospital sector are:

- 1 **ISO 9001** (quality management system certification). This focuses on all elements of quality management that a hospital company must implement for an effective system that allows it to manage and improve the quality of its hospital care and assistance services.
- 2 **ISO 14001** (certification of the environmental management system). This certification helps the hospital organization to identify, prioritize and manage environmental risks, as part of its usual business practices. In the current competitive situation, environment commitment has become a highly relevant variable, which has increased in recent years.
- 3 **ISO 26000** (social responsibility standard). This standard encourages organizations to go beyond compliance with legal regulations and contribute to sustainable development. It provides guidance on CSR principles, their implementation, recognition and the participation of stakeholders in fundamental aspects such as governance of the organization, human rights, labour practices, the environment, fair operating practices, consumers and active participation in the community.
- 4 **ISO 50001** (certification of the energy management system). This standard encompasses the energy management practices considered most appropriate worldwide. The main objective of the standard is to improve energy performance and energy efficiency continuously and identify opportunities for energy reduction.
- 5 **OHSAS 18001** (certification of the occupational health and safety management system) and **ISO 45001** (certification to improve and control occupational safety and health risks). These management systems allow companies to reduce occupational accidents, increase productivity, comply with legislation on prevention and promote a

preventive culture by integrating prevention into the company's general management system.

### 2.2.4. Indicator extraction and coding

In short, CSR indicators are reflected through accreditations, quality labels and sustainability reports (Satorras, 2002). Hospitals' corporate websites are a useful channel to increase transparency, highlight their CSR practices and enhance their position in relation to competitors (Nevado-Gil and Gallardo-Vázquez, 2016; Rodríguez-Cala et al., 2015).

Once the standards have been selected, the next step was to examine their presence or absence on hospitals' institutional web pages. Website analysis was carried out between January 2018 and March 2018 for all private hospitals in Spain. A dichotomous coding system was used in which the absence of each standard on the institutional webpages was coded as 0 and the presence was coded as 1 (Rodríguez-Bolívar et al., 2013).

## 2.3. Corporate social responsibility: financial indicators

In the academic literature, there is no clear consensus on the relationship between the adoption of CSR measures and the achievement of certain economic and financial results (Ramos et al., 2014; Margolis and Walsh, 2003; Orlitzky et al., 2003).

Some studies report a negative effect of CSR on financial outcomes. They establish that higher (lower) levels of CSR lead to worse (better) financial performance. This hypothesis is consistent with the view that the high costs of CSR actions reduce companies' profits and put them at a disadvantage compared to others (Friedman, 2007; Lioui and Sharma, 2012). In addition, some authors argue that companies that are trying to be socially responsible focus on areas that are not their core business, which reduces corporate profits, as companies cannot make competitive and social improvements at the same time (Ramos et al., 2014). See the meta-analysis in Horváthová (2010) for examples.

However, most empirical studies reject this view (García-Castro et al., 2010; Orlitzky et al., 2003) and suggest that there is a positive relationship between CSR and economic and financial outcomes (Creixans-Tenas and Arimany-Serrat, 2018; Conesa et al., 2016; Wang et al., 2015a; Gallardo-Vázquez and Sánchez-Hernández, 2014; Hammann et al., 2009). Specifically, it appears that companies can increase their economic performance through the application of CSR actions and policies (Chang, 2009). For instance, Heras and Arana (2011) show that companies with greater efficiency and competitive capacity, measured in terms of economic profitability and sales growth, have a greater propensity to develop CSR practices or actions.

Several authors highlight the importance of CSR as a tool for increasing profits, since companies that adopt the three dimensions of CSR can become better businesses (Conesa et al., 2016; Ramos et al., 2014). Thus, although there is no clear consensus in the debate on the relationship between the adoption of CSR measures and profitability, most research suggests that there should be a positive relationship between both variables (Wang et al., 2015b; Horváthová, 2010); In short, those companies with higher levels of social responsibility should have positive profitability differentials (Valenzuela et al., 2015). The financial variables in this study and the academic literature supporting their use are shown in Table 1.

**Table 1**  
Academic justification of the chosen financial variables.

|                        |                                                                                                                                         |
|------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|
| Operating income       | AECA (2018); Valenzuela et al. (2015)                                                                                                   |
| Solvency               | Lee (2015); García-Sánchez et al. (2013)                                                                                                |
| Indebtedness           | AECA (2018)                                                                                                                             |
| Return on assets (ROA) | Creixans-Tenas and Arimany-Serrat (2018); Conesa et al. (2016); González et al. (2014); Heras and Arana (2011); Lioui and Sharma (2012) |
| Return on equity (ROE) | Conesa et al. (2016); Gonzalez et al. (2014)                                                                                            |

## 2.4. Method

### 2.4.1. Financial ratios as carriers of relative information about positive magnitudes

Most of the indicators in Table 1 fall under the category of financial ratios. Financial ratios can be used to compare the relative magnitudes of accounts in financial statements. When they are treated as variables in statistical analyses, financial ratios may have a number of serious statistical and practical problems, such as asymmetry, outliers, redundancy, severe non-normality and even dependence of the results on an arbitrary decision regarding which account appears in the numerator and which in the denominator (see Linares-Mustarós et al., 2018 for a review).

In other scientific fields, there is a well-developed toolbox for analysing the relative importance of magnitudes, known as compositional data analysis (CoDa: Pawlowsky-Glahn et al., 2015; Van den Boogaart and Tolosana-Delgado, 2013; Aitchison, 1986). Among other features, CoDa treats account values in a symmetric fashion in such a way that the results do not depend on numerator and denominator permutation. CoDa also tends to reduce outliers and non-normality and treats redundancy by acknowledging that no financial statement analysis requires more ratios than there are account magnitudes to be compared.

CoDa emerged in the fields of geology and chemistry. These disciplines typically focus on the relative importance of the components of the whole rock or substance under analysis, while the size of the rock or chemical sample is deemed irrelevant. After a seminal book by Aitchison (1986), thirty-five years of development led to a well-established standard CoDa toolbox that is covered in text books (Filzmoser et al., 2018; Greenacre, 2018; Pawlowsky-Glahn et al., 2015; Van den Boogaart and Tolosana-Delgado, 2013). Recently, CoDa has been applied in finance and accounting to answer research questions concerning relative magnitudes. Examples include crowdfunding (Davis et al., 2017), financial markets (Kokoszka et al., 2019; Ortells et al., 2016; Wang et al., 2019), municipal budgeting (Voltes-Dorta et al., 2014), investment portfolios (Boonen et al., 2019; Belles-Sampera et al., 2016), product portfolios (Joueid and Coenders, 2018) and insurance pricing (Verbelen et al., 2018). CoDa has been successfully applied in multivariate descriptive studies of financial statements (Linares-Mustarós et al., 2018; Carreras-Simó and Coenders, 2019, in press). To the best of our knowledge, this is the first scholarly article to introduce CoDa in statistical models to predict financial statements from non-financial variables. The following sections present a summary of the method. See Creixans-Tenas et al. (2019) for details.

### 2.4.2. Financial statement accounts as compositional data

Compositional data are positive vector variables carrying information about the relative size of their  $D$  components (Aitchison, 1986):

$$\mathbf{x} = (x_1, x_2, \dots, x_D) \quad \text{with} \quad x_j > 0, j = 1, 2, \dots, D.$$

Some rules must be followed to introduce financial statement accounts in a composition: to avoid negative accounts and account overlap. Account overlap is easy to avoid by not using both totals and their constituents. For instance, fixed assets and current assets should be used instead of fixed assets and total assets.

Negative accounts are a rather more problematic issue and their use is advised against in the financial literature, because they can cause discontinuity, outliers or even a reversal of interpretation when the account that may be negative is in the denominator (Linares-Mustarós et al., 2018; Carreras-Simó and Coenders, 2019, in press; Lev and Sunder, 1979). In general, accounts are negative because they imply some form of subtraction of other positive accounts, which are the ones to be used. This means, for instance, that when ratios are built, revenue and operating costs should be used directly rather than operating income. This limitation implies no loss of information whatsoever. For instance, a ratio conveying the same information as the classical margin ratio (*operating income/revenue*) can be constructed only from the non-negative

magnitudes of revenue and operating costs. Let  $z_1$  = revenue,  $z_2$  = operating costs,  $z_3 = z_1 - z_2$  = operating income. The always positive revenue over operating costs ratio ( $z_1/z_2$ ) can easily be shown to be just a transformation of the problematic operating income over revenue ratio ( $z_3/z_1$ ):

$$\frac{z_1}{z_2} = \frac{z_1}{z_1 - z_3} = \frac{1}{\frac{z_1 - z_3}{z_1}} = \frac{1}{1 - \frac{z_3}{z_1}}.$$

In this article, the components represented by the  $x_j$  variables are the following  $D = 6$  positive and non-overlapping accounts:

- $x_1$ : fixed assets
- $x_2$ : current assets
- $x_3$ : long-term liabilities
- $x_4$ : short-term liabilities
- $x_5$ : revenue
- $x_6$ : operating costs

These accounts make it possible to compute some of the most common indicators in Table 1, like the current ratio =  $x_2/x_4$  (solvency), the debt ratio =  $(x_3 + x_4)/(x_1 + x_2)$  (indebtedness), the debt quality ratio =  $x_3/x_4$  (indebtedness), turnover =  $x_5/(x_1 + x_2)$  and the margin ratio that we discussed above =  $x_5/x_6$ . Other more problematic ratios that involve potentially negative accounts are  $\text{ROE} = (x_5 - x_6)/(x_1 + x_2 - x_3 - x_4)$  and  $\text{ROA} = (x_5 - x_6)/(x_1 + x_2)$ , and the classical margin ratio =  $(x_5 - x_6)/x_5$ . It is well-known that ROA and ROE are functions of indebtedness, margin and turnover, which allows the latter to replace the former.

Accounts were obtained from the SABI (Iberian Balance sheet Analysis System) database, developed by INFORMA D&B in collaboration with Bureau VanDijk. Search criteria were private hospital companies in Spain with data available for 2016.

### 2.4.3. Transformations. Compositional pairwise financial ratios

The usual approach to CoDa is to use existing standard statistical methods on transformed data. *Logarithms of ratios* are the standard transformation in CoDa (Pawlowsky-Glahn et al., 2015). A log-ratio involving only two components might be computed as:

$$y = \log_2 \left( \frac{x_1}{x_2} \right),$$

where  $\log_2$  stands for the logarithm to base 2 for the sake of interpretability. When the log-ratio increases by one unit the ratio doubles. Positive values of the log-ratio mean that  $x_1$  is larger than  $x_2$ , e.g. when  $y = 3$ ,  $x_1 = 2^3 x_2$ . Negative values show the opposite behaviour. A zero log-ratio implies equality of both magnitudes, in the same way as a unit standard ratio.

Unlike a standard ratio, which is bounded between zero and infinity, a log-ratio is symmetric in the sense that its range is from minus infinity to plus infinity. In addition, permuting the numerator and denominator components leads to the same distance from zero and affects no property of the log-ratio other than the sign:

$$\log_2 \left( \frac{x_1}{x_2} \right) = - \log_2 \left( \frac{x_2}{x_1} \right).$$

Furthermore, if one of the components that is being compared is close to zero, it may lead to an outlying standard ratio when it is placed in the denominator and to a typical ratio when placed in the numerator. In log-ratios, placement makes no difference (Linares-Mustarós et al., 2018).

It can be shown that just  $D-1$  log-ratios contain all information about the relative importance of  $D$  components and thus prevent the redundancy problems encountered in the financial literature when a very large number of ratios are used, some of which are unavoidably exact functions of other ratios. Chen and Shimerda (1981) put forward an example of four exactly redundant indebtedness ratios: net worth to liabilities,

liabilities to net worth, net worth to assets and liabilities to assets. Just one of these ratios carries the same information as the entire set of four.

Several choices are possible to select  $D-1$  log-ratios (Egozcue et al., 2003). Greenacre (2019) recommends computing log-ratios only among pairs of components, on the grounds of their simpler interpretation. He appropriately calls these *pairwise log-ratios*. In order to avoid redundancy, cyclical relationships among components must be avoided (Greenacre, 2019). For example, if log-ratios  $\log_2(x_1/x_2)$  and  $\log_2(x_2/x_3)$  have already been selected, then  $\log_2(x_1/x_3)$  is no longer a candidate for selection, since it can be computed from the others.

For this purpose, Greenacre (2019) recommends drawing a graph in which the components are vertices (nodes) and the log-ratios are connections (edges). The graph must necessarily be connected (all components must participate in at least one log-ratio) and acyclic. This means that there may not be closed circuits, that is, when the edges of the graph are followed from one vertex to any other vertex, no vertex can be visited twice. Such a graph has exactly  $(D-1)$  edges. While any graph that fulfils these conditions will suffice, it is good practice to use a graph with substantive interpretation, based on expert knowledge or in the light of the available theories and the research purpose (e.g. Table 1).

As argued above, a comparison of revenue and operating costs provides a notion of margin, which is one of the constituents of ROA:

$$y_1 = \log_2 \left( \frac{x_5}{x_6} \right).$$

We can define an indicator of turnover, which is the second constituent of ROA, by comparing revenue and fixed assets:

$$y_2 = \log_2 \left( \frac{x_5}{x_1} \right).$$

The well-known current ratio (short-term solvency indicator) compares current assets and short-term liability:

$$y_3 = \log_2 \left( \frac{x_2}{x_4} \right).$$

Debt quality (indebtedness indicator) can be assessed by comparing long- and short-term liability:

$$y_4 = \log_2 \left( \frac{x_3}{x_4} \right).$$

Finally, one extra log-ratio can provide information on the relative weight of fixed and current assets:

$$y_5 = \log_2 \left( \frac{x_2}{x_1} \right).$$

The corresponding graph is in Fig. 1.

#### 2.4.4. Modelling

Once the  $y_1$  to  $y_5$  log-ratios have been computed, they can be introduced as dependent variables in statistical models to relate them to non-financial information. These models range from linear models such as MANOVA and ordinary least squares regression (Tolosana-Delgado and Van den Boogaart, 2011) to structural equation models (SEM: Kogovšek et al., 2013), which include covariance-based SEM and partial-least-squares SEM (PLS-SEM).

The models can then be estimated using standard methods and software and the compositional nature of the variables is duly considered when the results are interpreted. According to the way in which accounts are placed in the numerator and the denominator of the log-ratios:

- A positive effect on  $y_1$  is interpreted as increasing the margin, either by increasing revenue or by reducing operating costs.
- A positive effect on  $y_2$  is interpreted as increasing the turnover, either by increasing revenue or by decreasing fixed assets.
- A positive effect on  $y_3$  is interpreted as improving short-term solvency, either by increasing current assets or by reducing short-term liability.
- A positive effect on  $y_4$  is interpreted as improving debt quality either by increasing long-term liability or by decreasing short-term liability.
- A positive effect on  $y_5$  is interpreted as either increasing current assets or decreasing fixed assets.

When a variable is measured with multiple indicators, such as CSR practices in our case, PLS-SEM has gained widespread acceptance in the management, accounting and finance literature (Hair et al., 2012; Lee et al., 2011). There are two main arguments for using PLS-SEM rather than covariance-based SEM. First, PLS-SEM is a more convenient and flexible approach to formative outer models (Hair et al., 2011, 2012; Lee et al., 2011). Second, PLS-SEM can handle small sample sizes ( $n = 107$  in our case) although the bootstrap procedure used to test the model is

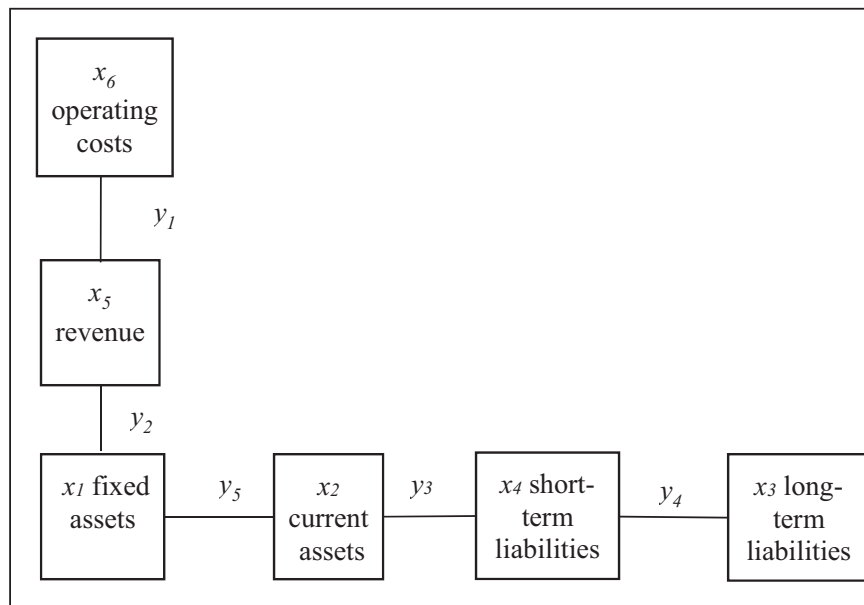


Fig. 1. Graph diagram used in this article. Each edge between two nodes represents their log-ratio.

no-longer robust to non-normality, if it is severe (Hair et al., 2012).

The final model specification is as follows:

- $d_1$  to  $d_5$  are dummy-coded indicators of the CSR dimension that indicate whether the website shows accreditations related to the issue:
  - $d_1$ : GRI report (35% of sample hospitals)
  - $d_2$ : JCI quality accreditation (26%)
  - $d_3$ : ISO 14001 accreditation (59%)
  - $d_4$ : ISO 50001 accreditation (20%)
  - $d_5$ : ISO 26000 accreditation (15%)
- $y_1$  to  $y_5$  are dependent variables, each being its own dimension, i.e. single-item measures.
- $\text{lemp} = \log_2(\text{emp})$  is the logarithm of the number of employees as a control variable to take hospital size into account. It is also a single-item measure (mean = 8.08; SD = 1.28; min = 3; max = 11.61; corresponding to 409, 490, 8 and 3129 employees, respectively).

In the outer model relating the multiple indicators to their dimensions, we conceptualise  $d_1$  to  $d_5$  as formative indicators because socially responsible firms may be so by adopting them in any combination. Thus, correlations among  $d_1$  to  $d_5$  are not expected to be high and should not be high, for the sake of collinearity (Diamantopoulos and Winklhofer, 2001). Table 2 shows that some correlations are indeed low at around 0.3. In the inner model,  $y_1$  to  $y_5$  depend on the CSR dimension and on  $\text{lemp}$ . The path diagram is shown in Fig. 2.

#### 2.4.5. Normality assessment

Univariate and multivariate normality assessment for  $y_1$  to  $y_5$  was conducted by means of Anderson-Darling tests as recommended by Aitchison (1986; `adtest` command in the R package `robCompositions`, v. 1.3.3). Skewness, kurtosis and test results are in Table 3. As argued above, the lack of extreme non-normality is especially important for the relatively small sample sizes available. For comparison, the same normality diagnostics are presented for some standard financial ratios, whose use would thus be unwise for PLS-SEM with this sample size. It must be considered that very high positive kurtosis also signals the presence of extreme outliers.

#### 2.4.6. Model fit assessment

PLS estimation was carried out with the R packages `plspm`. `formula` (v. 1.0.1) and `plspm` (v. 0.4.9). The path weighting scheme was used as recommended (Hair et al., 2011; Lee et al., 2011), with tolerance set at  $10^{-6}$  and 20,000 replications for the bootstrap procedure.

As recommended by Hair et al. (2011) and Ruiz-Molina et al. (2018), the outer formative model is not only assessed from the perspective of weight significance, but also standardized loading sign, size and significance, variance inflation factor (VIF) and relevance from a content validity point of view. According to these criteria, we decided to keep all five CSR practices in the model (GRI, JCI, ISO 14001, ISO 50001, and ISO 26000).

According to the literature review, additional CSR indicators had been considered in a previous model: EFQM accreditation, OHSAS 18001 and ISO 9001 certifications, and the sustainability report. When OHSAS 18001, ISO 9001 and the sustainability report were dropped, the maximum VIF went down from 6.23 to 2.49. OHSAS 18001 was redundant with ISO 50001 (correlation = 0.74), ISO 9001 was redundant with ISO 14001 (correlation = 0.89), and the sustainability report was redundant with the GRI report (correlation = 0.76). High correlations only mean that the variables that are involved cannot coexist in the same model, but can potentially be used interchangeably. EFQM was dropped from the model for another reason: it had a negative weight (Ruiz-Molina et al., 2018) and thus did not have the same relationships with financial structure as the remaining CSR indicators.

As recommended by Hair et al. (2012), the inner model is assessed from R-squared values and bootstrap confidence intervals of standardized paths.

### 2.5. Results and discussion

Table 4 shows the model estimates, including standardized outer model bootstrapped weights and loadings and their corresponding bootstrapped means, standard errors, confidence intervals and variance inflation factors, the standardized inner model paths and their corresponding bootstrapped confidence intervals and R squared values. Even if two outer weights are non-significant according to the confidence intervals (ISO 14001 and ISO 50001), they all have a positive sign, and the size and significance of outer loadings shows all CSR practices to have a high absolute contribution to the CSR construct. The VIF values are also reasonable and show that the portion of the variance of each item explained by the remaining items is not too large (Ruiz-Molina et al., 2018). Thus, the GRI, JCI, ISO 14001, ISO 50001 and ISO 26000 accreditations constitute a formative construct in the prediction of financial structure, meaning that all five indicators can be assumed to affect financial structure in the same way, in spite of the fact that they address different types of practices, including safety, quality, labour, governance, energy and the environment.

According to the confidence intervals for the inner model paths, CSR practices tend to significantly reduce turnover ( $y_2$ ) and increase debt quality ( $y_4$ ), while they have no impact on margin, short-term solvency or asset distribution. Specifically, investment in obtaining SCR accreditations, such as in energy efficiency and emissions, efficiency of waste management, human capital and good corporate governance (AECA, 2018), as evidenced by the investigation, involves investments in non-current assets, which may result in an increase in longer term debt. This could explain the reduction in fixed asset turnover and the increase in the share of long-term debt within liabilities. The effect of CSR on the share of current assets within total assets, although insignificant, is the third largest in standardized terms, and its sign is consistent with an increase in non-current assets.

The percentages of explained variance are admittedly low. The number of employees is meant only to control for hospital size, but some readers

**Table 2**  
Correlation matrix.

|               | $y_1$  | $y_2$  | $y_3$  | $y_4$  | $y_5$  | $d_1$  | $d_2$  | $d_3$  | $d_4$  | $d_5$  | $\text{lemp}$ |
|---------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|---------------|
| $y_1$         | 1.000  | -0.070 | 0.253  | 0.008  | 0.034  | -0.024 | 0.046  | 0.161  | 0.001  | -0.084 | -0.056        |
| $y_2$         | -0.070 | 1.000  | 0.239  | -0.361 | 0.860  | -0.205 | -0.091 | -0.166 | -0.070 | -0.205 | 0.170         |
| $y_3$         | 0.253  | 0.239  | 1.000  | -0.011 | 0.517  | -0.113 | -0.078 | 0.022  | 0.078  | -0.126 | 0.036         |
| $y_4$         | 0.008  | -0.361 | -0.011 | 1.000  | -0.266 | 0.186  | 0.092  | 0.132  | 0.162  | 0.257  | -0.053        |
| $y_5$         | 0.034  | 0.860  | 0.517  | -0.266 | 1.000  | -0.165 | -0.036 | -0.082 | 0.043  | -0.219 | 0.190         |
| $d_1$         | -0.024 | -0.205 | -0.113 | 0.186  | -0.165 | 1.000  | 0.551  | 0.608  | 0.482  | 0.577  | 0.151         |
| $d_2$         | 0.046  | -0.091 | -0.078 | 0.092  | -0.036 | 0.551  | 1.000  | 0.454  | 0.562  | 0.347  | 0.288         |
| $d_3$         | 0.161  | -0.166 | 0.022  | 0.132  | -0.082 | 0.608  | 0.454  | 1.000  | 0.413  | 0.350  | 0.044         |
| $d_4$         | 0.001  | -0.070 | 0.078  | 0.162  | 0.043  | 0.482  | 0.562  | 0.413  | 1.000  | 0.453  | 0.215         |
| $d_5$         | -0.084 | -0.205 | -0.126 | 0.257  | -0.219 | 0.577  | 0.347  | 0.350  | 0.453  | 1.000  | 0.141         |
| $\text{lemp}$ | -0.056 | 0.170  | 0.036  | -0.053 | 0.190  | 0.151  | 0.288  | 0.044  | 0.215  | 0.141  | 1.000         |

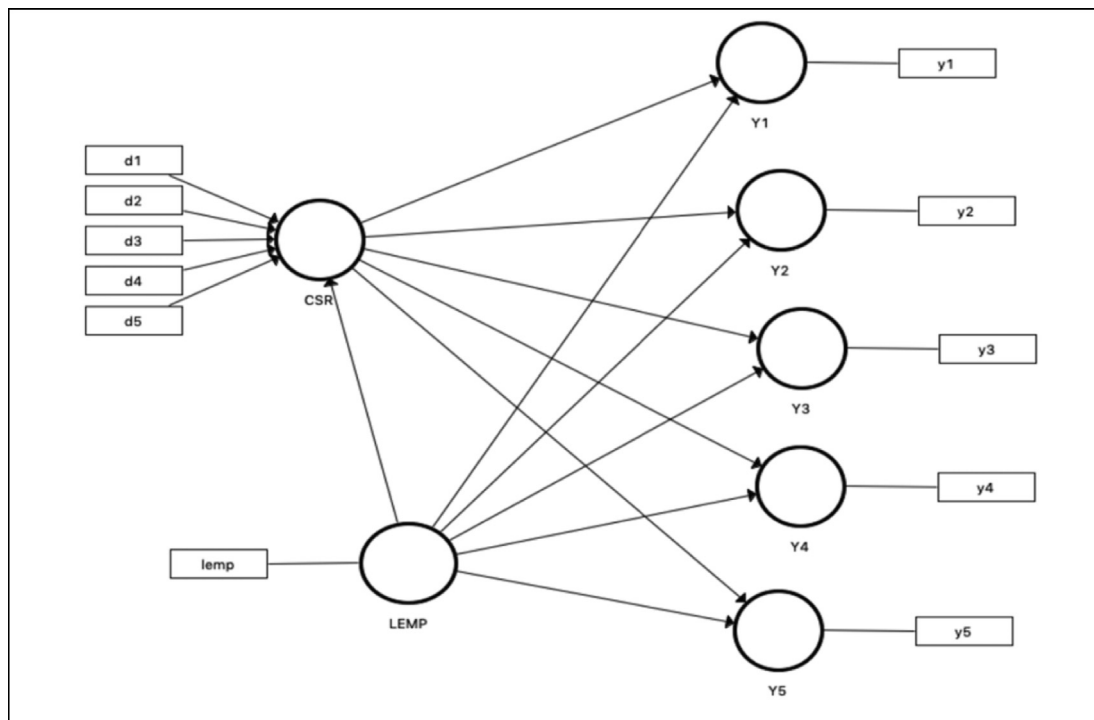


Fig. 2. SEM path diagram.

Table 3

Univariate and multivariate normality assessment of pairwise log-ratios and selected standard financial ratios.

|                                                   | skewness | kurtosis | A-D test p-value |
|---------------------------------------------------|----------|----------|------------------|
| $y_1 = \log_2(x_5/x_6)$                           | 1.09     | 2.57     | <0.001           |
| $y_2 = \log_2(x_5/x_1)$                           | 0.85     | 1.67     | 0.006            |
| $y_3 = \log_2(x_2/x_4)$                           | 0.62     | 2.06     | 0.221            |
| $y_4 = \log_2(x_3/x_4)$                           | -0.47    | -0.13    | 0.150            |
| $y_5 = \log_2(x_2/x_1)$                           | 0.75     | 0.45     | 0.003            |
| Multivariate test $y_1$ to $y_5$                  | –        | –        | <0.001           |
| $r_1 = (x_5 - x_6)/x_5$                           | 0.67     | 1.70     | 0.004            |
| $r_2 = x_5/(x_1 + x_2)$                           | 1.56     | 2.91     | <0.001           |
| $r_3 = x_2/x_4$                                   | 7.24     | 63.69    | <0.001           |
| $r_4 = x_3/x_4$                                   | 2.87     | 10.69    | <0.001           |
| $r_5 = x_2/x_1$                                   | 5.01     | 32.07    | <0.001           |
| $r_6 = ROE = (x_5 - x_6)/(x_1 + x_2 - x_3 - x_4)$ | 0.38     | 25.44    | <0.001           |
| $r_7 = ROA = (x_5 - x_6)/(x_1 + x_2)$             | 0.50     | 1.05     | 0.016            |
| Multivariate test $r_1$ to $r_7$                  | –        | –        | <0.001           |

may wish to interpret the fact that larger hospitals tend to have a higher turnover and a higher proportion of current assets within total assets.

For comparison, the same PLS-SEM was rerun by substituting  $r_1$  to  $r_5$  as defined in Table 3 for  $y_1$  to  $y_5$ . When doing so, five of the parameters in Table 4 changed their status from statistically significant to insignificant or vice-versa. In this particular application, using standard financial ratios or ratios constructed as CoDa did make a difference, and, according to Hair et al. (2012) we deem the CoDa estimates more trustworthy because of lack of extreme non-normality. Results are not shown but they are available from the authors on request.

### 3. Conclusions

#### 3.1. Concluding remarks

This article relates the financial indicators and the corporate social responsibility (CSR) indicators of hospitals in the Spanish private health system using CoDa methodology and PLS-SEM.

Table 4

Standardized original PLS estimates. Bootstrap means, standard errors, 95% confidence intervals, and VIF of the outer model.

| Outer weights  | Original | Mean   | Std. Error | Perc. 025 | Perc. 975 | VIF   |
|----------------|----------|--------|------------|-----------|-----------|-------|
| CSR- $d_1$     | 0.815    | 0.784  | 0.215      | 0.442     | 1.211     | 2.338 |
| CSR- $d_2$     | 0.576    | 0.572  | 0.241      | 0.083     | 1.016     | 1.751 |
| CSR- $d_3$     | 0.492    | 0.527  | 0.279      | -0.046    | 1.010     | 1.661 |
| CSR- $d_4$     | 0.386    | 0.404  | 0.263      | -0.131    | 0.856     | 1.685 |
| CSR- $d_5$     | 0.698    | 0.597  | 0.267      | 0.110     | 1.134     | 1.602 |
| Outer loadings | Original | Mean   | Std. Error | Perc. 025 | Perc. 975 |       |
| CSR- $y_1$     | 0.892    | 0.873  | 0.075      | 0.747     | 0.933     |       |
| CSR- $y_2$     | 0.749    | 0.735  | 0.118      | 0.448     | 0.873     |       |
| CSR- $y_3$     | 0.743    | 0.741  | 0.104      | 0.512     | 0.872     |       |
| CSR- $y_4$     | 0.695    | 0.678  | 0.123      | 0.401     | 0.842     |       |
| CSR- $y_5$     | 0.715    | 0.678  | 0.115      | 0.438     | 0.845     |       |
| Inner paths    | Original | Mean   | Std. Error | Perc. 025 | Perc. 975 |       |
| CSR- $y_1$     | 0.034    | 0.047  | 0.116      | -0.168    | 0.281     |       |
| CSR- $y_2$     | -0.251   | -0.253 | 0.094      | -0.410    | -0.041    |       |
| CSR- $y_3$     | -0.089   | -0.086 | 0.123      | -0.300    | 0.179     |       |
| CSR- $y_4$     | 0.238    | 0.240  | 0.103      | 0.018     | 0.423     |       |
| CSR- $y_5$     | -0.189   | -0.192 | 0.116      | -0.378    | 0.081     |       |
| lemp-CSR       | 0.210    | 0.213  | 0.107      | -0.012    | 0.406     |       |
| lemp- $y_1$    | -0.063   | -0.073 | 0.130      | -0.305    | 0.189     |       |
| lemp- $y_2$    | 0.223    | 0.217  | 0.090      | 0.032     | 0.382     |       |
| lemp- $y_3$    | 0.055    | 0.051  | 0.102      | -0.139    | 0.256     |       |
| lemp- $y_4$    | -0.103   | -0.101 | 0.081      | -0.253    | 0.062     |       |
| lemp- $y_5$    | 0.230    | 0.228  | 0.084      | 0.059     | 0.391     |       |
| R-Squares      | Original | Mean   | Std. Error | Perc. 025 | Perc. 975 |       |
| CSR            | 0.044    | 0.057  | 0.045      | 0.001     | 0.165     |       |
| $y_1$          | 0.004    | 0.033  | 0.032      | 0.001     | 0.118     |       |
| $y_2$          | 0.089    | 0.104  | 0.052      | 0.017     | 0.218     |       |
| $y_3$          | 0.009    | 0.031  | 0.030      | 0.001     | 0.110     |       |
| $y_4$          | 0.057    | 0.074  | 0.045      | 0.007     | 0.179     |       |
| $y_5$          | 0.070    | 0.091  | 0.046      | 0.017     | 0.192     |       |

$d_1$ : GRI;  $d_2$ : JCI;  $d_3$ : ISO 14001;  $d_4$ : ISO 50001;  $d_5$ : ISO 14001;  $y_1$ : margin;  $y_2$ : turnover;  $y_3$ : solvency;  $y_4$ : debt quality;  $y_5$ : asset distribution.

From a methodological perspective, CoDa offers distinct advantages in statistical modelling of the structure of financial statements by reducing redundancy, asymmetry and outliers. Once log-ratios have been computed, statistical analysis becomes standard in all respects, and researchers may use their favourite models, estimation methods and software, as we have shown in the case of PLS-SEM. The proposed method of financial statement analysis involves computing logarithms of financial ratios between pairs of the  $D$  accounts of interest in such a way that all accounts are connected. Once  $D$  strictly positive relevant accounts of interest have been selected,  $D-1$  log-ratios suffice. CoDa can be understood as a way to select the minimum number of variables that carry all information about the relative importance of any account to any other. Log-ratios also tend to be less deviant from the normal distribution (Creixans-Tenas et al., 2019; Linares-Mustarós et al., 2018). A further relevant issue when CoDa is applied to financial statement analysis is that the accounts of interest may contain no zero values for log-ratios to be computed. The same holds for standard financial ratio analysis regarding the account in the denominator. Unlike standard financial ratio analysis, CoDa includes an advanced toolbox for zero imputation (Martín-Fernández et al., 2011). CoDa thus makes financial statement analysis possible when some accounts of interest equal zero (Carreras-Simó and Coenders, 2019, in press), although no zero account values were encountered in this study.

From a substantive point of view, the research shows that some relevant financial indicators on the profitability and survival of hospitals are related to CSR practices. Drawing on the controversial nature of the relationship between profitability and CSR as reported in the literature (Conesa et al., 2016; Horváthová, 2010; Ramos et al., 2014; García-Castro et al., 2010; Friedman, 2007), out of the three concepts underlying ROE and ROA (turnover, margin and indebtedness), CSR has been found to affect turnover in a negative way, and to affect indebtedness only regarding the structure of debt. However, a higher share of long-term debt within total debt may constitute a measure of responsible financial management and increase survivability. The need to increase fixed assets to embark on CSR practices is also in accordance with the literature review (Cochran and Wood, 2017) and may explain the observed turnover reduction.

As regards management implications, the GRI report is the non-financial CSR indicator that is most relevant to the financial structure of hospitals, followed by the JCI accreditation and the ISO 26000 management system. Hospitals that implement these indicators can have and provide integrated information that makes their economic, social and environmental reality more transparent. The investments needed to implement the CSR practices should best be financed by long-term debt in order to increase financial resilience (Jansson, 2018). Private hospital companies should also improve their revenue management, in order that the increased assets resulting from CSR practices do not affect turnover in too serious a manner.

This suggests that, in the hospital companies, the continuous improvement of the different management systems and their integration is a necessity for a good management of health services. The development of an integrated management model allows hospital companies to make better operational decisions (Voinea and Pamfilie, 2009). On the other hand, when operating through an integrated system there are positive synergies in organizations resulting in cost and time savings, optimization of available resources, staff involvement and performance improvement (Simon et al., 2013; Domingues et al., 2015).

With respect to CSR, integrated management systems facilitate its inclusion in the management of organizations (Asif et al., 2013). Currently, the Spanish Act 11/2018 derived from Royal Decree 18/2017 which is present in Directive (2014)/95/EU of the European Parliament and of the Council, emphasizes the need to present non-financial information, especially for companies with assets above 20 million euros, with revenue above 40 million euros and with more than 500 workers currently or 250 workers from 2021 onwards. This non-financial information integrated with the financial information provides more reliable

information of the organization (Adams, 2015). It should be noted that CSR emerges in times of crisis (Janssen et al., 2015) and as of 2008 the systemic crisis favours more transparency in business management (Melé et al., 2011).

## Declarations

### Author contribution statement

All authors listed have significantly contributed to the development and the writing of this article.

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The authors declare no conflict of interest.

### Additional information

No additional information is available for this paper.

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