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FEP FACULDADE DE ECONOMIA UNIVERSIDADE DO PORTO

EARNINGS QUALITY: EVOLUTION AND RELATIONSHIP WITH THE ECONOMIC CYCLE. AN APPROACH BASED ON AN INDEX CONSTRUCTION

Mariana Oliveira Barbosa

Dissertation

Master in Management

Supervised by

Professor José António Cardoso Moreira

Professor Jorge Manuel Afonso Alves

2020/2021

Acknowledgements

I would like to thank everyone who contributed directly or indirectly to the completion of this dissertation.

First, I would like to thank my supervisors, professor José Moreira and professor Jorge Alves, whose expertise and knowledge were invaluable during the writing of the dissertation. I would also like to thank them for their availability, constant feedback, and the support.

I would like to acknowledge SIFEP for always being available and quickly solving any problems that occurred with the software used to obtain results.

I would like to thank all professors from the master's and undergraduate degree who contributed to my growth as a person and as a professional.

Finally, I would like to thank my family and friends for the emotional support given during the writing of the dissertation. I could not have completed this dissertation without them.

Abstract

Earnings quality (EQ) is a widely discussed theme among the accounting scientific community. This research emerges from a theoretical gap about the topic, normally, the measurement of this concept is based on one variable. However, EQ is multidimensional concept that depend on several factors. Besides that, this research intends to understand relationship between the economic cycle and the EQ, since many studies have shown opposite results. For this, an index which considers different dimensions of EQ was constructed. The index includes three dimensions, discretionary manipulation, sales manipulation, and cost of goods sold manipulation. The economic cycle indicator used was the GDP growth rate. Thus, the results showed that there is a negative relationship between the economic cycle and EQ.

Keywords: earnings quality, earnings management, earnings smoothing, conservatism, predictability, index, relationship, GDP growth rate; economic cycle.

List of Acronyms

A – Total assets

ACOGS- Abnormal cost of goods sold

AS- Abnormal sales

CF- Cash flows

CFO- Cash flow from operations

COGS- Cost of goods sold

DA- Discretionary accruals

EQ- Earnings quality

GDP- Gross domestic product

PEE- Gross property, plant, and equipment

R^2- Coefficient of determination

R^2a – coefficient of determination adjusted

REC - Receivables

REV- Revenues

ROA- Return on assets

S- Sales

SABI- *Sistema De Análise De Balanços Ibéricos*

TA-Total accruals

WC- Working capital

Contents

List of figures

List of tables

1. Introduction

Financial information corresponds to the aggregation of the most relevant quantitative and qualitative data of an entity. In this sense, the accounting information quality is relevant for the users of this information for the decision-making process, including managers, customers, state and specifically for investors (Bhattacharya, Desai, & Venkataraman, 2013). This information allows different stakeholders to assess the performance of a company at a certain point in time and makes them create a sense of the company's value. Although, the value of the company is determined by future actions the best way to predict future results is through past financial/ accounting information. In this sense, the importance of the earning management theme also emerges. " Earning management occurs when managers use their judgement in financial reporting and in structuring transaction to alter financial reports to either mislead some stakeholders about underlying economic performance of the company or to influence contractual outcomes that depend on reported accounting numbers" (Wahlen & Healy, 1999, p. 368). Although earnings management is the most studied dimension of earnings quality (EQ), it is not the only one (Licerán-Gutiérrez & Cano-Rodríguez, 2017). Thus, there is a theoretical gap, normally the quality is measured only in terms of one of EQ dimensions or characteristics (Licerán-Gutiérrez & Cano-Rodríguez, 2017).

Besides that, EQ is inherent to the relevance, quantity, and capacity that this information may have for decision making and for measuring the performance of an entity (P. Dechow, Ge, & Schrand, 2010). However, to overstate or understate economic, financial, and organizational performance, some entities resort to mechanisms that end up deteriorating the quality of financial information. Previous studies showed that in response to financial crisis and to deal with poor financial condition, companies engage in earnings management (e.g. Dutzi & Rausch, 2016; Ming Chia, Pong, Lapsley, & Lee, 2007; Xu & Ji, 2016). However, some other studies showed the opposite results, they conclude that during the financial crisis, earnings management decreases (e.g. Cimini, 2014; Kousenidis, Ladas, & Negakis, 2013; Zarowin, 2007). Thus, there is a theoretical gap, as the relationship between the economic cycle and EQ is not clear.

Thus, the objectives of this dissertation are to understand EQ evolution over time and to understand the relationship between EQ and the economic cycle through a multidimensional analysis. This study will allow stakeholders to better understand the evolution of EQ. In this sense, the main research questions will be: How does the EQ evolve over time? What is the relationship between EQ and the economic cycle?

In this sense the Portuguese case was chosen. There are studies that analyse aspects of EQ of Portuguese companies but did not focus on an analysis of the temporal evolution of this information and its relationship with the economic cycle (e.g. Carmo, 2013; Marques, Rodrigues, & Craig, 2011; Mendes & Rodrigues, 2006).

In addition, the methodology used is quantitative and based on the construction of an index. The construction of the index was developed by combining different proxies to assess EQ between 2011-2019. The index was built adopting 3 proxies that estimate different dimensions of the EQ (discretionary manipulation, sales manipulation, cost of sales manipulation). To estimate the proxies, a cross sectional analysis was chosen (by industry and by year) (e.g. Kothari, Leone, & Wasley, 2005).

This research showed that in Portugal the relationship between EQ and the economy cycle is negative. In the ascending phase (or boom phase), there is more recourse to manipulation of results than in the descending phase (or recession phase).

So, first, a literature review will be presented showing the concept of EQ, different dimensions that affect EQ, how to measure this quality and the relationship between earning management and the economic cycle. Then, a section containing methodology will be presented. First, the objective of the study is described, and next, the steps to build the EQ index will be described. Then, a section on the data will be shown. This section contains data selection, sample characterization, and quality assessment of proxies fit. Then, the results and analysis of the research is presented, showing not only the temporal evolution of the EQ but also the relationship with the economic cycle. Finally, conclusions, limitations and possible future investigations will be presented.

2. Literature review

2.1 Financial information quality concept

Financial information quality is an accounting topic very discussed by the scientific community, as evidenced by the various studies carried out on the topic (e.g Carmo, 2013; P. Dechow et al., 2010; Licerán-Gutiérrez & Cano-Rodríguez, 2017). Besides that, FIQ is commonly called earnings quality (EQ).

Financial information represents all information (quantitative or qualitative) that is formally disclosed by companies. Normally, financial information ends up being confused with accounting information, predominantly of a quantitative nature, prepared according to the assumptions and characteristics defined and disclosed through the financial statements. Among all the disclosed information, the accounting earnings is the one with the greatest information content (Carmo, 2013).

In this sense, the definition for the EQ is given by : "Higher quality earnings provide more information about the features of a firm's financial performance that are relevant to a specific decision made by a specific decision-maker" (P. Dechow et al., 2010). Thus, there are 3 main characteristics of the EQ. First, the quality depends on their relevance for making a specific decision, so it is not a universal concept and is not inseparable from the context in which the decision is made. Second, the quality of the earnings depends on its ability to capture the relevant aspects of the company's performance. And third, the quality of the earnings depends not only on the relevance of the information it contains on the company's performance, but also on how the accounting system captures and transmits that information (P. Dechow et al., 2010).

Finally, is important to note that EQ is not easily detected, which makes it necessary to try to develop several proxies, based on the various accounting properties of financial information, as a method of measuring it. As none of these proxies demonstrate a predictive capacity superior to the others, EQ is considered as a multidimensional concept (Licerán-Gutiérrez & Cano-Rodríguez, 2017). The only possible way to measure it is using the financial information disclosed by the companies. However, this information does not always reflect a true and appropriate image of the real economic and financial situation of

a company, as this information is often misrepresented. Thus, the main dimensions of EQ are earnings management , earnings smoothing, conservatism and predictability (Licerán-Gutiérrez & Cano-Rodríguez, 2017; Roychowdhury, 2006).

2.2 Measuring earnings quality

This section analyses the measures frequently used in the literature to understand the EQ. This analysis will be done according to the dimensions of the earnings quality which are earnings management, earnings smoothing, conservatism, predictability. And finally a section that links EQ with the economic cycle will be presented.

2.2.1 Earnings management

There are two main ways to explain EQ. Second, earnings managements "occurs when managers use their judgement in financial reporting and in structuring transaction to alter financial reports to either mislead some stakeholders about underlying economic performance of the company or to influence contractual outcomes that depend on reported accounting numbers" (Wahlen & Healy, 1999, p. 368). In this sense, earnings management can occur in three ways: through the flexibility allowed by accounting standards; using real results manipulation practices; and, finally, through the fraudulent manipulation of the financial information and commercial transactions (Alves & Moreira, 2014).

2.2.1.1 Earnings management through discretionary manipulation

EQ is a function of the way the accounting system captures and transmits information about the company's performance. As such, one of the most influential aspects of the FI is the flexibility of accounting standards. Accounting standards are more flexible when they provide the manager with more accounting options or when they give the choice of certain accounting treatments to their discretion. In view of greater flexibility, the manager may have two types of action: managers can use their discretion to choose the solution that provides the most relevant information to the users of financial information; or they can act in an opportunistic way, making accounting options that allow them to achieve a certain objective (Guay, Kothari, & Watts, 1996). Consequently, the way managers act affects the quality of information.

In general, earning management occurs through the subtle use of financial information by managers to obtain advantages for themselves or for the company. These manager options may lead to the financial statements not to convey a true and appropriate image of the company's economic and financial situation, leading to the misrepresentation of the image of the company to stakeholders (Carmo, 2013; Licerán-Gutiérrez & Cano-Rodríguez, 2017).

One of the most recurring limitations pointed out in these papers is the fact that the existing techniques for measuring the manipulation of earnings are not very strong and are not very accurate (P. M. Dechow, Hutton, Kim, & Sloan, 2012) . The typical procedure for the detection and measurement of discretionary manipulation is based on a linear regression in two phases, that is, first the discretionary accruals (DA) are estimated as the residual component of a linear regression and then this residual component is used as a dependent variable in a second linear regression as a way to test the research hypotheses (Chen, Hribar, & Melessa, 2018). According to the same authors, in the second phase of the regression, most studies omit the independent variables used in the first phase, causing the results obtained to be biased. Although it presents some deficiencies, the most common proxy for detecting and measuring result manipulation, is based on isolating this discretionary component of accruals. In order to limit the deficiencies pointed out to this type of proxy, several models have been developed that allow separating accruals into their normal and abnormal components. Thus, normal accruals result from the normal activity of the company and are obtained through the adjusted values of the models. As for abnormal accruals, they are given by the residuals of the models and can present a positive or negative sign, being measured in absolute value, these indicate that the higher the value, the greater the discretion and, consequently, the lower will be the quality of the earnings (Carmo, 2013) . Table 1 shows some of the most used models for detecting discretionary earnings manipulation.

Table 1- Discretionary manipulation models

(1) Jones (1991) Model $TA = \alpha + \beta_1 \Delta REV_{i,t} + \beta_2 PPE_{i,t} + \varepsilon_{i,t}$	Jones' model considers the change in revenues in a year and the level of tangible fixed assets as explanatory variables for accruals. The first variable aims to ascertain the effect that the changes in the company's normal activity originate in total accruals. As for the variable of tangible fixed assets, this controls the effect of depreciation on total accruals, considering that these also represent normal accruals, that is, their recognition and measurement is not affected by the manager's discretion. Finally, the residuals in the formula represent the discretionary component of accruals (Jones, 1991).
(2) Jones model modified by Dechow, Sloan and Sweeney (1995). $TA = \alpha + \beta_1(\Delta REV_{i,t} - \Delta REC_{i,t}) + \beta_2 PPE_{i,t} + \varepsilon_{i,t}$	It is possible to observe that the change in the model consisted in removing the variation in net receivable from the variation in sales. With this, the intention was to remove the effect of credit sales on accruals, since it is not uncommon for these sales to translate into profit manipulation practices. In case of this type of situation, credit sales represent abnormal accruals, and should not be reflected in the change in the revenues (P. M. Dechow, Sloan, & Sweeney, 1995).
(3) Jones model modified by Kothari, Leone and Wasley (2005). $TA = \alpha + \beta_1(\Delta REV_{i,t} - \Delta REC_{i,t}) + \beta_2 PPE_{i,t} + \beta_3 ROA_{i,t} + \varepsilon_{i,t}$	The authors added a new variable, the Return on Assets Ratio (ROA). This change aims to control the level of performance of a company in determining abnormal accruals, since for the authors, the results obtained in models 1 and 2 are correlated with the performance of the company and can lead to wrong conclusions regarding companies with high performances (Kothari et al., 2005).
(4) Dechow and Dichev (2002) model $\Delta WC_{i,t} = \alpha + \beta_1 CFO_{i,t-1} + \beta_2 CFO_{i,t} + \beta_3 CFO_{i,t} + \varepsilon_{i,t}$	In this model the accruals measure is changes in working capital. This model focuses on the relationship that is established over time between cash flows and accruals. In this sense, normal short-term accruals result from the sum of past, present and future cash flows. As for DA, these are obtained through model residues. Besides that, their standard deviation is used as a proxy to measure the EQ, and it is considered that the greater this variability, the lower the quality of the information (Dichev & Dechow, 2002)
(5) Dechow and Dichev model modified by McNichols (2002) $\Delta WC_{i,t} = \alpha + \beta_1 CFO_{i,t-1} + \beta_2 CFO_{i,t} + \beta_3 CFO_{i,t} + \beta_4 \Delta REVi,t + \beta_5 PPE_{i,t} + \varepsilon_{i,t}$	The changes are reflected in the introduction in the model of Dechow and Dichev (2002) of the explanatory variables of the Jones' model (1991). With this, the author intended to exclude from the DA the accruals associated with the variation of the company's normal activity and depreciations (Carmo, 2013; McNichols, 2002).
(6) Model by Francis, LaFond, Olsson, and Schipper (2005) $\sigma(\varepsilon_{i,t}) = \lambda_0 + \lambda_1 Size_{i,t} + \lambda_2 \sigma(CFO)_{t,i} + \lambda_3 \sigma(Sales)_{t,i} + \lambda_4 OperCycle_{i,t} + \lambda_5 NegEarn_{i,t} + \mu_{i,t}$	Like most models, Francis, LaFond, Olsson, and Schipper (2005) model is based on distinguishing the two components of accruals, normal and abnormal. The first component is explained by variables such as company size, operating cash flows and sales. These factors depend on external factors to the company and are not directly linked to the management. As for the second component, the discretionary component,

	this is a consequence of the accounting choices of managers who, for opportunistic reasons, make decisions that end up hiding the true and appropriate image of the financial statements (Francis, LaFond, Olsson, & Schipper, 2005)
(7) Model by Dechow et al. (2012) $WC\ TA_{i,t} = a + bPART_{i,t} + cPARTR_{i,t} + \sum_{k} f_k X_{k,i,t} + \varepsilon_{i,t}$	Dechow et al. (2012) propose a new approach for detecting the discretionary manipulation that aims to determine the abnormal component of accruals more adequately (Carmo, 2013). In this sense, accruals originating in one period will be reversed in the following periods, and this way, and if the researcher has a antecedents that proves in which period they will be reversed, this model will bring greater scientific robustness and will overcome some of the gaps of the previous modules(P. M. Dechow et al., 2012).
(8) Model by Larson, Sloan and Giedt (2018) $Ta_{i,t} = \alpha_0 + \alpha_1 EMPGR_{i,t} + \alpha_2 EMPGR_{i,t} * NCI_{i,t-1} + \alpha_3 CF_{i,t} + \sum_{\tau=1}^{L} (\alpha_{3+\tau} CFO_{i,t-\tau} + \alpha_{3+L+\tau} CFO_{i,t-\tau} + \alpha_{3+2L+1} PL\_MTLB_{i,t}) + \varepsilon_{i,t}$	Larson, Sloan and Giedt (2018) developed a new theory that aims to determine accruals based on three factors: business growth, temporary differences between the economic fact and the cash flows associated with it and, finally, the asymmetric incorporation of earnings and losses in results. As these three variables have a great explanatory value in relation to the normal component of accruals, individual proxies were developed related to the three factors that aim to explain the normal component of accruals, with the residuals of the model representing the DA. The result of this new theory is a compilation of three proxies in a single model with explanatory capacity for the three factors mentioned above (Larson, Sloan, & Zha Giedt, 2018).

Definition of variables:

TA-total accruals; REV- revenues; PEE- gross property, plant, and equipment; ε-residuals; REC- net receivables; ROA- return on assets; CFO- cash flow from operations; WC- working capital; σ- standard deviation; Size- Variable that represents the size of the company; OperCycle - log of exploration cycle duration; NegEarn - Proportion of years with negative results in the last 10 years; μ – Residues of the Francis et al. (2005); PART - Dichotomous variable (1 = presumed result manipulation; 0 = remaining periods); PARTR - Dichotomous variable (1 = reversal of accruals associated with earnings manipulation; 0 = other periods); X_k - Set of k variables to control the accrual model; EMPGR – employment growth rate; NCI – Equity; PL_MTLB – ratio between the market value at the end of the period and the market value at the beginning; i - index that represents the company; t - index that represents time.

2.2.1.2 Earnings management through real activities manipulation

The use of real activities manipulation practices can be defined as departures from the practice of normal operational activities, motivated by the managers intention to lead the stakeholders to believe that certain goals were reached in the normal course of operations (Roychowdhury, 2006). The author also mentions that in most cases these practices do not necessarily contribute to create value in the company, being only a way for managers to achieve the objectives that allow them to obtain advantages for themselves. A good example of this is the practice of radical discounts, these may have an underlying goal of reaching a certain volume of sales that will consequently bring a financial benefit to the manag-

er (Roychowdhury, 2006).

In the medium and long run, the recurrent use of these practices results in destroying value. Using the previous example, the use of radical discounts to increase sales, with some frequency leads to a decrease in gross margin and can lead consumers to wait for more discounts in the future. Consequently, in the future the gross margin continues to decrease, which has a negative effect on future cash flows from operation (CFO) (Roychowdhury, 2006). To detect the practice of real activities manipulation, normally, the variables that have the greatest influence on the results of companies are studied. Thus, to detect this practises, sales and cost of goods sold are analysed. Table 2 shows the best-known model to captures real activities manipulation.

Table 2- Real manipulation models

(1) Sales manipulation model (Roychowdhury, 2006) $CFO_t/At\text{-}1=\alpha_1 + \alpha_2(1/A_{t-1}) + \alpha_3(S_t/A_{t-1}) + \alpha_4(\Delta S_t/A_{t-1})+ \varepsilon_t$	This model assumes that normal CFOs are the ones that a company should register if there was no sales manipulation. Abnormal CFOs, which are a proxy for real sales manipulation, are given by the residuals of the model (Roychowdhury, 2006). In this way, the further away from zero the model residues are, the more there is real sales manipulation and, consequently, the lower the EQ.
(2) Cost of sales manipulation model (Roychowdhury, 2006) $COGS_t/A_{t-1} = \alpha_1 + \alpha_2(1/A_{t-1}) + \alpha_3(S_t/A_{t-1}) + \varepsilon_t$	This model is used to identify the existence of abnormal COGS by comparing it to the invoiced sales (Roychowdhury, 2006). In some cases, managers are led to consider a COGS higher than what would be normal given the volume of sales , which causes an inflation of costs and consequently decrease in EQ (Alves & Moreira, 2014)

Definition of variables:

CFO- cash flows from operations; A – total assets; S- sales; COGS- Cost of goods sold; ε-residuals; t - index that represents time

2.2.2 Earnings smoothing

One of the basic principles of an accounting system is that earnings without major fluctuations become more useful and reliable for decision making (P. Dechow et al., 2010). Thus, it can be said that the earnings quality would be greater the smaller the fluctuations in the earnings of a company are. The smoothing of earnings leads to a more informative and predictive character. However, several studies (e.g. Black, Pierce, & Thomas, 2017; Lennox, Wu, & Zhang, 2016; Leuz, Nanda, & Wysocki, 2003) indicate that smoothness occurs as a way for managers to overshadow the real economic and financial performance

of the company, and when this happens, it is considered that this practice is closely linked to the manipulation of earnings and, as a consequence, it is indicative of a low EQ.

In this sense, a true smaller variability of the earnings is considered by the analysts as a better indicator for the evaluation of a company, since the margin of error will also be smaller. However, when managers use private information about future earnings, to resort to earnings smoothing mechanisms to increase their relevance, this can ultimately reduce earnings quality. This way, it is necessary to develop measures to distinguish the two types of smoothness: the smoothness that provides better quality of earnings and the smoothness that that deteriorate the quality of earnings (Carmo, 2013; P. Dechow et al., 2010; Licerán-Gutiérrez & Cano-Rodríguez, 2017). The most used ways to measure the earnings smoothing is the ratio between the standard deviation of earnings and the standard deviation of cash flows or the correlation between changes in accruals and changes in cash flows (P. Dechow et al., 2010). Table 3 shows the main models to captures manipulation through smoothness.

Table 3-Models to measure smoothness

(1) Model by Dechow at el. (2010) σ(Earnings)/σ(Cash flows)	This model analyses the behaviour of earnings in relation to cash flows. In this sense, whenever there is a smoothing of transient fluctuations in cash flows through accruals, the results will tend to show less variability compared to that presented by cash flows. Thus, it can be concluded that a lower ratio between the standard deviation of earnings and the standard deviation of cash flows will indicate a greater smoothing of earnings, since the variability of results in relation to cash flows is lower (P. Dechow et al., 2010).
(1) Model by Dechow at el. (2010) corr(ΔAccruals, ΔCash flows)	The model studies the correlation between accruals and cash flows. In accounting, the assumption of increase is used, thus, it is assumed that the correlation between the variations of these two factors is, as a rule, negative (Carmo, 2013). However, the negative correlations between variations in accruals and variations in high magnitude cash flows are considered an obvious indicator of smoothing results (Leuz et al., 2003).
(2) Model by Black et al. (2017) σ(fictitious year Earnings)- σ(fiscal year Earnings)	This model consists of the development of the study first carried out by Jacob and Jorgensen (2007). Black et al. (2017), created fictitious years not fully coinciding with the fiscal year. More specifically, authors start their years in the last quarter of the previous year. This new model has a clear advantage over the

	others, which is related to the fact that the volatility of a fiscal year is compared with a fictitious year, while the other models compare completely different terms such as accruals and cash flows (Black et al., 2017). Now, the authors consider that the other models are doomed, because they correlate two factors that it is known from the outset that their correlation is negative (Black et al., 2017).
Definition of variables: σ – standard devation	

2.2.3 Conservatism

Conservatism or asymmetric timeliness reflets "the accountants tendency to require a higher degree of verification for recognizing good news than bad news in financial statements" (Basu, 1997). This way, conservatism indicates the asymmetry in the degree of verifiability required for the recognition of gains and losses. Conservatism stems from the principle of prudence and makes the risk and uncertainty of the company's performance reflected in accounting (FASB, 1980).

Conservatism manifests itself through two distinct currents: unconditional conservatism and conditional conservatism. The first, representing an *ex ante* accounting perspective (or new independent), determines a lower degree of verifiability required for recording the patrimonial facts and has as a consequence the recording of these facts even before they happen (e.g., recognition of accounting depreciations greater than tax depreciations) (Beaver & Ryan, 2005). As for the second aspect, an *ex post* perspective (news dependent), conditional conservatism translates into a greater requirement in the degree of verifiability of events so that they can be recognized in the accounts (Basu, 1997; Beaver & Ryan, 2005).

Being in the presence of conservatism, earnings reflect bad news quicker than good news, therefore, the conservative earnings have a greater association with the negative returns compared to the positive ones (Carmo, 2013). There is a generalized idea in the scientific community that defends conservatism in the financial information as a means of combating the natural optimism of managers (P. Dechow et al., 2010). Conservatism configures an asymmetry in the recognition of expenses and income, that is, the accountant usually requires a greater degree of verifiability for the recognition of income than ex-

penses. This attitude may have as a possible consequence an unrealistic reflection of the company's economic and financial situation, as it runs the risk of undervalued assets and overvalued liabilities, and in this case, conservatism deteriorates EQ (Carmo, 2013; P. Dechow et al., 2010). However, this property of the financial information embodies a clear mechanism to reduce the generalized optimism of managers who seek to manipulate earnings to obtain their own benefits, and in this case, conservatism ends up increasing the EQ (P. Dechow et al., 2010).

Table 4- Models to measure conservatism

(1) 1º Basu (1997) Model $Earnings_t = \alpha_0 + \alpha_1 D_t + \beta_0 R_t + \beta_1 D_t * R_t + \varepsilon_t$	This model is considered the most effective method of detecting conservatism, being based on information from financial markets, it assumes that they are efficient. In the presence of conservatism, the ratio $(\beta 0 + \beta 1) / \beta 0$ should be greater than 1, this indicates that the result's sensitivity to bad news is higher than the result's sensitivity to good news (Carmo, 2013). Despite being the most widely used proxy, several drawbacks to the Basu (1997) model are pointed out, the main limitation is that this model can only be used with companies listed on the stock exchange, since it is based on information from the market and assumes that markets are efficient (P. Dechow et al., 2010).
(2) 2º Basu (1997) Model $\Delta NI_t = \alpha_0 + \alpha_1 ND_{t-1} + \alpha_2 \Delta NI_{t-1} + \alpha_3 (ND_{t-1} * \Delta NI_{t-1}) + \varepsilon_t$	This model is entirely based on information taken from the financial statements. Considering that conservatism translates into more timely recognition of bad news, it usually ends up affecting only one economic year, while the good news is reflected throughout the following years. Thus, negative variations tend to be less persistent and to revert more quickly, this translates into a prediction that $\alpha_3 < 0$ (Basu, 1997; P. Dechow et al., 2010). Thus, it is concluded that the greater the α_3, the greater the level of conservatism of earnings (Basu, 1997).
(3) 1º Basu Model (1997) modified Khan and Watts (2009) $Earnings_t = \alpha_0 + \alpha_1 D_t + R_t (\mu_1 + \mu_2 Size_t + \mu_3 M/B_t + \mu_4 LEV_t) + D_t R_t(\lambda_1 + \lambda_2 Size_t + \lambda_3 M/B_t + \lambda_4 LEV_t) + (\delta_1 Size_t + \delta_2 M/B_t + \delta_3 LEV_t + \delta 4 D_t Size_t + \delta_5 D_t M/B_t + \delta_6 D_t LEV_t) + \varepsilon_t$	This model is based on the 1º Basu Model (1997). However, the coefficients $\beta 0$ and $\beta 1$ translate into linear functions composed of intrinsic and distinctive characteristics of each company (Khan & Watts, 2009). Thus, a model was built based on three basic characteristics that the authors consider as the main features of conservatism: the size of the company, the ratio between market value and book value and the degree of financial leverage. The application of this model consists of replacing the β coefficients with these variables and, in effect, ascertaining the annual conservatism (Khan & Watts, 2009) .
Definition of variables: D - dichotomous variable (1 = negative returns; 0 = positive returns); R -returns; ε – residuals; ND - dichotomous variable (1 = variation in the income t-1 is negative; 0 = variation in the income t-1 is positive; NI- income; Size – Dimension of the company; M/B –	

2.2.4 Predictability

Being one of properties of the financial information, predictability refers to the ability that an agent interested in the financial statements has, based on the earnings of previous years, to forecast the company's earnings for a short / medium term (P. Dechow et al., 2010). In the context of company valuation, it is generally accepted that more consistent earnings represent a better predictive indicator for company valuation models, namely from the perspective of free cash flows. In other words, more persistent earnings are more predictable and therefore have better quality than more disparate earnings (Carmo, 2013; P. Dechow et al., 2010; Licerán-Gutiérrez & Cano-Rodríguez, 2017). This property is associated with the persistence of earnings, since these are a better predictive indicator of future earnings.

However, for earnings to remain persistent and consequently be a better indicator of future earnings, this may imply that managers resort to mechanisms of manipulation or smoothing, which translates into earnings distortion and consequent decrease in the EQ (P. Dechow et al., 2010; Licerán-Gutiérrez & Cano-Rodríguez, 2017). Table 5 shows the models used to estimate predictability.

Table 5- Models to measure predictability

(1) Freeman et al. (1982) model $Earnings_{t+1} = \alpha + \beta Earnings_t + \varepsilon_t$	According to this model, the variable β represents the predictability of the results and the closer it is to 1, the greater the predictive capacity of current results in relation to future results, considering that this represents a greater persistence of results (P. Dechow et al., 2010; Licerán-Gutiérrez & Cano-Rodríguez, 2017).
(2) Sloan (1996) model $Earnings_{t+1} = \alpha + \beta_1 CF_t + \beta_2 Accruals_t + \varepsilon_t$	This model was developed based on the model by Freeman et al. (1982) and consists of the decomposition of earnings into two factors of the greatest importance for their determination. Thus, Sloan (1996) decomposed current results into cash flows and accruals, believing that these factors have an excellent predictive capacity for future earnings. In his study, the author proved that $\beta 2 < \beta 1$ which means that the cash flow component is substantially more persistent than the accruals component, that is, according to this model, cash flows are more determinant for the calculation of future results than accruals (P. Dechow et al., 2010)
(3) Dechow et al. (2010) model $Earnings_{t+1} = \alpha + \delta_1 Earnings_t + \delta_2$ Financial statements components $+\delta_3$ Other information$_t + \varepsilon_t$	This model is the evolution of the previous model proposed by Sloan (1996). With this model, the authors intend to develop a more extensive measure than the previous one that allows to determine if other components of the financial statements and other variables substantially influence the earnings, thus increasing the empirical robustness of the model (P. Dechow et al., 2010). With this, the authors leave the choice of these variables to the investigator's free will, since from sector to sector or from company to company, the most significant variables may be different.
Definition of variables: CF- cash flows; ε – residuals; t - index that represents time	

2.3 Earnings quality and economic cycle

Regarding earnings quality related to the economic situation, there are several studies that indicate that manipulation is greater when the economic situation is worse (e.g. Alfraih, 2016; Dutzi & Rausch, 2016; Ming Chia et al., 2007; Xu & Ji, 2016). However, there are also studies that point in the opposite direction (e.g. Cimini, 2014; Kousenidis et al., 2013; Zarowin, 2007).

The economic cycle is an alternation between economic expansion and contraction. The economic cycle can be divided into four phases (recession, floor, expansion, and peak) or it can be divided into two phases (ascending or boom and descending or recession), this cycle is commonly called the business cycle. The divisions of the cycle mainly depend on the gross domestic product (GDP) growth rate (e.g. Wang, Li, & Chen, 2015). When the macroeconomy is in recession the GDP growth rate tends to be low and the economic prospect negative (Wang et al., 2015). The opposite happens in the boom, the GDP growth rate tends to be high and the economic prospects positive (Wang et al., 2015).

Prospect theory says that people's sensitivity to gains and losses are asymmetric, there is more pain in the loss than happiness in the gain and consequently, there is a manifestation of loss aversion behaviour by the decision maker (Kahneman & Tversky, 1979; Wang et al., 2015). This theory can be transposed to the market, if in the boom of the business cycle companies announce negative news about earnings, investors will tend to respond strongly (Wang et al., 2015). Under these circumstances, if companies show better earnings than expected, there will not be such an intense reaction (Wang et al., 2015). Thus, in a boom phase, there is an incentive to manipulate information in case of poor company performance.

Managers compensation often does not depend only on better earnings, it also depends on operational performance compared to the competition (Wang et al., 2015). Thus, if the performance is below the industry average, even if the result is greater than in the homologous period, it is considered that the company is not maximizing the interests of investors. In this sense, questions about management capacity are made and, normally, it affects managers compensation (Wang et al., 2015). Therefore, competitive pressure becomes an incentive to manipulate earnings, which can lead to a decrease in EQ (Wang et

al., 2015). In this sense, in the boom phase of the business cycle, normally, earnings manipulation is positive and therefore pro-cyclical (Wang et al., 2015).

Regarding the recession phase of the macro economy, inventors have pessimistic expectations about the future, so the recession can serve as an excuse for the companies' poor performance (Wang et al., 2015). So, there is no incentive to manipulate earnings taking into consideration managers compensation (Wang et al., 2015). However, recession can lead to negative manipulation of earnings primarily to obtain government benefits (if any) and also, so that profits can be presented in the boom phase and thus ensure good results compared to competition (Wang et al., 2015).

It should be noted that there are incentives to manipulate earnings into all stages of the economic cycle, this may be the reason for the contradictory results in the studies described above.

3. Methodology

This section serves to explain the procedures used during the investigation in order to test the hypotheses. In the first subsection, the objective of the study is described. Then, the steps followed to construct the EQ Index.

3.1 Objective of the study

The main objectives of this dissertation are to understand how EQ evolves over the years and its relationship with the economic cycle using an approach based on a construction od an index. In this sense, the GDP growth rate was used as an indicator of the economic situation (e.g. Wang et al., 2015). In addition, another objective is to capture more than one dimension of the EQ by constructing an index.

As explained previously, one of the biggest weaknesses pointed to the measurement of the EQ is the fact that no proxy demonstrates a predictive capacity superior to the others, which makes the EQ a multidimensional concept. In this sense, the construction of an index that allows the aggregation of several dimensions is developed. Also, it is pointed out as a gap, the contradictory results regarding the relation of EQ with the economic cycle

Note that the index does not include smoothness, since "it is difficult to disentangle smoothness of reported earnings that reflects smoothness of the fundamental earnings process; accounting rules; and intentional earnings manipulation" (P. Dechow et al., 2010, p. 351). In addition, the conservatism and predictability measurement models are also not included. The use of these models was initially considered; however, it was not possible to include due to time constraints. The following table shows the variables, the weights as well as the model used for their measurement. For the discretionary manipulation the Jones model modified by Kothari, Leone and Wasley (2005) was chosen because this model is one of the most used having more than 2300 citations in Scopus data base and it is also the one described with the best results (e.g. Ali, Chen, & Radhakrishnan, 2007; Chaney, Faccio, & Parsley, 2011; Kim, Park, & Wier, 2012).. Regarding real activities manipulation, the two models developed to date will be used because they capture different methods of manipulation.

Table 6- Definition of the proxies used to calculate the index variables and its weights

Variables	Proxy	Authors	Weight
Discretionary manipulation	$TA/At\text{-}1 = \alpha + \beta_1((\Delta REV_{i,t}\text{-}\Delta REC_{i,t}) / A_{t-1})) + \beta_2 (PPE_{i,t} / A_{t-1}) + \beta_3(ROA_{i,t} / A_{t-1}) + \varepsilon_{i,}$	Kothari, Leone and Wasley (2005)	0.3(3)
Real activities manipulation	$CFO_t/At\text{-}1=\alpha_1 + \alpha_2(1/A_{t-1}) + \alpha_3(S_t/A_{t-1}) + \alpha_4(\Delta S_t/A_{t-1}) + \varepsilon_t$	Roychowdhury (2006)	0.3(3)
	$COGS_t/A_{t-1} = \alpha_1 + \alpha_2(1/A_{t-1}) + \alpha_3(S_t/A_{t-1}) + \varepsilon_t$	Roychowdhury (2006)	0.3(3)

3.2 Index construction

Statistically, an index is defined as a composite statistic, that is, an index is an indicator that aggregates several indicators (Hawken & Munck, 2012). The use of indexes has grown significantly in recent years due to three main factors: increase in the level of literacy (namely, statistical literacy); greater complexity of the economy and society; greater availability of information technology (Stiglitz, Sen, & Fitoussi, 2009).

In this sense, to construct an index, the following steps are needed:

3.2.1 Step 1: Theoretical framework

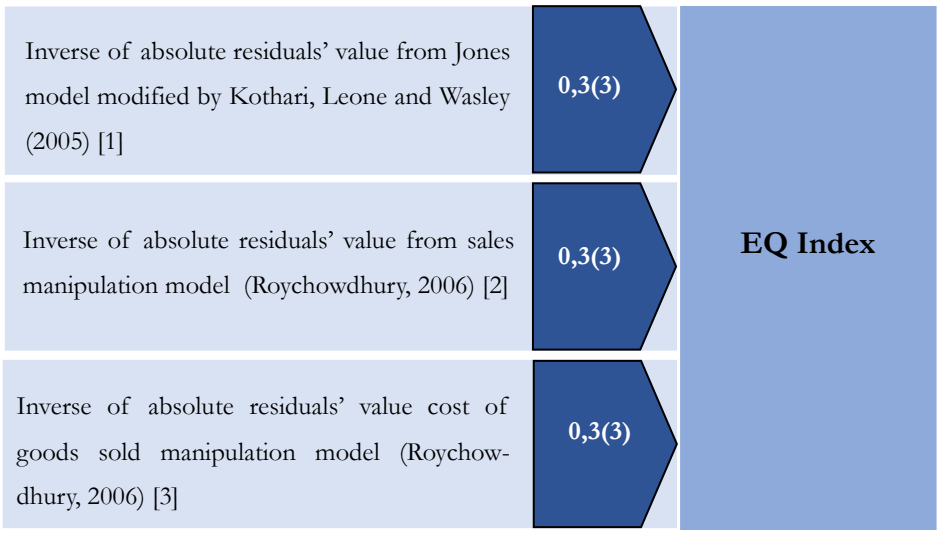
The theoretical framework is the first step to construct an index (or composite indicators). The framework should explain the phenomenon and its sub-components. So, the theoretical framework should show the selected individual indicators and the weights that indicate their relative importance and the dimensions that are going to be measured (Michela et al., 2008).

The theoretical framework used has already been synthetically described in the section objective of the study section. In this sense, below is a more detailed description of the framework.

Note that when the value of the variables is not directly observable, proxies are used (Michela et al., 2008). In this sense, since earnings manipulation is not directly measured, proxies were used instead of variables.

The selection of proxies has already been described previously. According to the literature review, the proxies are unidimensional. As stated previously, the proxies have the same weight, unless there is theoretical evidence against it (Babbie, 2012). In this sense, since there is no theoretical evidence against it, it was opted for weight equally distributed by proxies. The following figure illustrates in a simple way the construction of the index.

Figure 1- Theoretical framework



The framework indicates the EQ as a variable that is measured using the joint estimation of the proxies represented above. This fact tries to counteract a gap constantly pointed out in the most varied studies on EQ, which is related to the fact that, these studies estimate the EQ based on one of the proxies. Thus, with the selection of more proxies, it is intended to grant greater robustness to the study of the EQ, since these are expected to be proxies with a high explanatory character of the EQ. Then, each of the proxies is explained, based on what was mentioned in the literature review.

Model [1] represents the proxy of discretionary results manipulation based on the Jones model modified by Kothari, Leone and Wasley (2005) previously presented in the literature review, and which is transposed here again:

$$TA_t/A_{t-1} = \alpha + \beta_1((\Delta REV_{i,t}-\Delta RECi,t)\ /A_{t-1})\ ) + \beta_2(PPE_{i,t}\ /A_{t-1}) + \beta_3(ROA_{i,t}\ /A_{t-1}) + \varepsilon_{i,t} \quad [1]$$

As mentioned in the literature review, Jones' model (1991) considers the change in sales and the level of tangible fixed assets as explanatory proxies for DA. The model pro-

posed by Kothari, Leone and Wasley (2005) started from the initial modification made by Dechow, Sloan and Sweeney (1995), which was removing the variation in accounts receivable from the variation in sales. So, the intention of the authors was to remove the effect of credit sales in accruals, since for them, these sales are not rarely translated into practices of earnings manipulation (P. M. Dechow et al., 1995). Kothari, Leone and Wasley (2005) added a new variable, the Return on Assets Ratio (ROA). This change aims to control the performance level of a company in determining abnormal accruals, since for the authors, the results obtained in models on the Jones' Model (1991) and the Jones' Model modified by Dechow, Sloan and Sweeney (1995) are correlated with the company's performance level and can lead to wrong conclusions. As for the model's residuals, these represent the discretionary component to be studied and their result indicates that the farther from zero it is, the greater the manipulation of the results.

Regarding the model [2] presented below, it is, as previously described, the proxy normally used to detect the actual manipulation of sales and was developed by Roychowdhury (2006):

$$CFO_t/A_{t-1}=\alpha_1 + \alpha_2(1/A_{t-1}) + \alpha_3(S_t/A_{t-1}) + \alpha_4(\Delta S_t/A_{t-1}) + \varepsilon_t \quad [2]$$

This model represents the proxy used to detect whether entities use actual sales manipulation mechanisms to modify their financial information reporting. This model was proposed by Roychowdhury (2006) and assumes that normal CFOs are those that a company should register if there is no real manipulation of sales. In this way, the abnormal CFO is given by the model's residuals and identify the existence of abnormal behaviour in the Sales of the companies that are verified with greater intensity if its value deviates further from zero.

As for the model [3], it was also proposed by Roychowdhury (2006) and is, as explained in the literature review, normally used to detect any manipulations in the COGS:

$$COGS_t/A_{t-1} = \alpha_1 + \alpha_2(1/A_{t-1}) + \alpha_3(S_t/A_{t-1}) + \varepsilon_t \quad [3]$$

As for model [3], it is the second model developed by Roychowdhury (2006) and in this case it aims to identify the existence of COGS in relation to the Sales. As in the previous cases, the further away the abnormal value of the COGS is from zero, the greater is its

manipulation and, consequently, the worse is the EQ.

It should be noted that the models [1], [2] and [3] presented are estimated by year and by industry.

The index is calculated as the inverse of the mean of the absolute value of the residuals of each model. Since the mean of the residuals of the models is 0 and the deterioration of the EQ happens whether it is an upward or downward manipulation, the absolute value of the residuals is used. Besides that, considering the inverse of the proxies' residuals, it is possible, without incurring in any kind of bias, to read the index directly. So, a higher value corresponds to a higher EQ. Also, to facilitate an analysis using the 100-based index.

Inverse of absolute residuals' value from Jones model modified by Kothari, Leone and Wasley (2005) will be called discretionary accruals (DA). Inverse of absolute residuals' value from Sales manipulation model (Roychowdhury, 2006) will be called abnormal sales (AS) and the Inverse of absolute residuals' value cost of goods sold manipulation model (Roychowdhury, 2006) will be called abnormal cost of goods sold (ACOGS).

3.2.2 Step 2: Imputation of missing data

The development of robust indexes is often impeded by missing data (Michela et al., 2008). For the development of the EQ index, companies that did not have necessary data will be excluded. Thus, in a superficial analysis, this section would not be necessary. However, a data imputation criterion was defined so that this index can be updated annually.

There are three main methods to treat missing data: case deletion; multiple imputation and single imputation (Michela et al., 2008). In the first method, cases where there is missing data are omitted. The other two methods impute values to missing data. However, data imputation can be dangerous. "The idea of imputation is both seductive and dangerous. It is seductive because it can lull the user into the pleasurable state of believing that the data are complete after all, and it is dangerous because it lumps together situations where the problem is sufficiently minor that it can be legitimately handled in this way and situations where standard estimators applied to real and imputed data have substantial bias" (Dempster & Rubin, 1983, p. 8). Thus, it was opted for single imputation. In this case, the

imputed value is considered as the real value of the missing values (Michela et al., 2008). Furthermore, an implicit modelling was chosen. Implicit modelling approach considers underlying implicit assumptions that have to be verified in order to ensure that the imputation is reasonable (Michela et al., 2008). The biggest danger of this modelling approach is considering the data complete, forgetting the imputation (Michela et al., 2008).Finally, taking in account the implicit modelling, the substitution method was chosen for imputing the missing data (Michela et al., 2008). Then, it is suggested replacing companies that no longer have data available with new companies that were not part of the sample. Thus, a criterion that must be met so that the substitution can occur is proposed. This criterion aims for the companies (the substituted and the substitute) to be similar. Thus, the main accounts used in the models to estimate EQ were taken into consideration. It is intended that, on average, the divergence of each of the accounts used is less than 3.33%. In this sense, a substitution criterion was defined:

$$(((A_{n,t-1} - A_{O,t-1})/ A_{O,t-1}) + ((S_{n,t-1} - S_{O,t-1})/ S_{O,t-1}) + ((\Delta REC_{n,t-1} - \Delta REC_{O,t-1})/ \Delta REC_{O,t-1})$$
$$((PPE_{n,t-1} - PPE_{O,t-1})/ PPE_{O,t-1}) + ((ROA_{n,t-1} - ROA_{O,t-1})/ ROA_{O,t-1}))/5 \leq 3.33\%$$

Where: n- new company; O-old company with no data available; t- index that represents time

In addition, the companies must be from the same industry, if there are several companies that meet the criteria, the one with the least divergence must be chosen.

In case there is no company that fulfils the criterion, the use of the explicit modelling approach is proposed. This approach is based on statistical models where assumptions are made explicitly (Michela et al., 2008). Taking this approach into account, unconditional mean imputation is suggested. The sample mean of recorded values is used to replace missing data (Michela et al., 2008).

. Several methods of imputation must be tested in order to understand which one should be used (Michela et al., 2008). In this research, only one method of imputation method was proposed, and it was not tested.

3.2.3 Step 3: Multivariate analysis

An exploratory analysis should examine the indicators' structure. Besides that, it should assess the data set suitability and explain the methodological choices, for example, weighting (Michela et al., 2008). There are many statistical analyses that can be performed, so it was chosen to use the most frequent ones, that is, descriptive statistics to describe the sample and Pearson's correlation to understand the relationships between the different Index variables. Besides that, a lack of correlation in the principal variables is a valuable property. It suggests that the main variables are quantifying distinct "statistical dimensions" (Michela et al., 2008).

3.2.4 Step 4: Sensitivity analysis

A sensitivity analysis is a method that seeks to understand how much the result will be impacted if one of its variables is changed (Michela et al., 2008). This analysis is used to assess the robustness of an index because sometimes the index construction criteria are subjective and can be contested (Michela et al., 2008).

3.2.5. Step 5: Link to other measures

An attempt should be made to find reasons for the evolution of the index (Michela et al., 2008). For this, it can be used correlations and linear regressions (Michela et al., 2008) . These links can be used to test the explanatory power of a composite (Michela et al., 2008). Additionally, it is important to note correlation analysis should not be mistaken with causality analysis. Correlation only indicates that the variation in two datasets is similar (Michela et al., 2008). Thus, note that causality may not be demonstrated in a correlation analysis. Therefore, to meet the proposed objectives using linear regressions, correlations and Granger's causality test, the link between index variation and GDP growth rate will be presented in the results presentation section.

3.2.6 Step 6: Visualisation

At first sight, the presentation of the index seems trivial, however, it is not. An Index should represent a quick accurate "story" to decision makers and other end-users (Michela et al., 2008). Thus, it becomes of great importance to decide how this will be rep-

resented. Although there are others, the most used ways to represent an index are tables and graphs. Tables provide complete information however it can hide sensitive issues immediately visible with graphical representations. Thus, it was chosen to use both for the representation of the EQ index, this representation is found in the Presentation and Visualization of the EQ Index.

4. Data

4.1 Data collection and selection

To achieve the objectives defined above, it was necessary to extract and analyse various economic and financial data from companies. To this end, the Iberian Balance Sheet Analysis System (SABI) database was used. This is a research and data processing tool that provides various economic and financial indicators for Iberian companies. Initially, all companies available for the period 2010 to 2019 with total assets exceeding one million euros were selected. However, since several models require variations in variables and there was a change in the accounting system in 2009, the result for the year 2010 negatively affected the quality of the results. Thus, it was decided to create the index only between 2011 and 2019. For data processing, the Stata software was used. Stata is an integrated and complete software that offers most of data science needs (this is, data manipulation, visualization, statistics, and automated reports). In this sense, all sectors that had less than 15 companies per year were removed. So, only companies that had observations for all years and that met the aforementioned criteria were used. In addition, outliers were removed, it was decided to remove all observations that were above or below the average of TAt/At-1, CFOt/At-1 and COGSt/At-1 more than 3 standard deviations to meet fulfils the assumptions to use linear regression. It should also be noted that all the variables used to estimate the different models were obtained directly from the database, except for the CFO, as these are not mandatory. Thus, for companies that did not have the CFO available, they were calculated using the indirect method proposed by *Comissão de Normalização Contabilística*. See table 7 for a summary of the sample construction

Table 7- Construction of the sample

Description	Obs (n)	Companies(n)
SABI database	208 728	23 192
Sample after elimination of outliers	188 793	20 977
Sample with 15 or more observations per industry and per year	150 489	16 721

4.2 Sample characterization

Before presenting the results obtained with the analysis model, it is of utmost importance to understand the sample in question. Thus, it is essential to understand which activities are carried out by the companies in the sample. table 8 summarizes the main business activities carried out by the companies according to their Classification of Economic Activity (specifically CAE-Rev.3). To calculate the results, the 2 digits CAE-Rev.3 (2 digits CAE-Rev.3 is usually referred to as division) was used, in the sample this corresponds to 63 industries.

Considering table 8, presented in the next page, it can be concluded that the economic activity with the greatest contribution to the sample of 16 721 companies is the industry 46, which is wholesale trade (includes agents), except of motor vehicles and motorcycles industry with 2569 companies representing 15.36% of sample. It is also possible to observe that industry 68 (real estate activities) and industry 41 (real estate promotion (development of building projects); building construction) complete the top 3 companies with the greatest representation in the sample, representing, together, 36.46%of its total. Naturally, the remaining industries represent 63.54% of the sample. The economic activity with the lowest representation in the sample is research and security activities (industry 80), with 16 companies present in the sample. As for the observations, these are the reflection of the number of years.

Table 8- Activity of companies present in the sample

Industry (CAE REV. 3)	Obs (n)	Obs(%)	Company (n)	Company (%)
01	5 679	3.77%	631	3.77%
02	819	0.54%	91	0.54%
03	153	0.10%	17	0,10%
08	927	0.62%	103	0.62%
10	3 726	2.48%	414	2.48%
11	1 611	1.07%	179	1.07%
13	2 304	1.53%	256	1.53%
14	1 980	1.32%	220	1.32%
15	1 674	1.11%	186	1.11%
16	1 737	1.15%	193	1.15%
17	621	0.41%	69	0.41%
18	1 089	0.72%	121	0.72%
20	963	0.64%	107	0.64%
21	279	0.19%	31	0.19%
22	1 728	1.15%	192	1.15%
23	3 114	2.07%	346	2.07%
24	459	0.31%	51	0.31%
25	4 941	3.28%	549	3.28%
26	180	0.12%	20	0.12%
27	585	0.39%	65	0.39%
28	1 701	1.13%	189	1.13%
29	711	0.47%	79	0.47%
30	207	0.14%	23	0.14%
31	1 413	0.94%	157	0.94%
32	558	0.37%	62	0.37%
33	675	0.45%	75	0.45%
35	1 539	1.02%	171	1.02%
36	450	0.30%	50	0.30%
38	1 008	0.67%	112	0.67%
41	12 645	8.40%	1 405	8.40%
42	2 484	1.65%	276	1.65%
43	2 502	1.66%	278	1.66%
45	4 491	2.98%	499	2.98%
46	23 121	15.36%	2 569	15.36%
47	11 358	7.55%	1 262	7.55%
49	2 952	1.96%	328	1.96%
50	162	0.11%	18	0.11%
52	2 016	1.34%	224	1.34%
55	5 733	3.81%	637	3.81%

56	1 197	0.80%	133	0.80%
58	3 42	0.23%	38	0.23%
59	279	0.19%	31	0.19%
61	171	0.11%	19	0.11%
62	1 116	0.74%	124	0.74%
64	4 653	3.09%	517	3.09%
66	288	0.19%	32	0.19%
68	19 098	12.69%	2 122	12.69%
69	585	0.39%	65	0.39%
70	2 682	1.78%	298	1.78%
71	1 746	1.16%	194	1.16%
73	477	0.32%	53	0.32%
74	261	0.17%	29	0.17%
77	774	0.51%	86	0.51%
78	162	0.11%	18	0.11%
79	405	0.27%	45	0.27%
80	144	0.10%	16	0.10%
81	297	0.20%	33	0.20%
82	1 251	0.83%	139	0.83%
85	1 017	0.68%	113	0.68%
86	2 169	1.44%	241	1.44%
87	351	0.23%	39	0.23%
93	549	0.36%	61	0.36%
96	180	0.12%	20	0.12%
Total	150 489	100%	16 721	100%

Table 9 presents some descriptive statistics of the studies variables as well as other generic characteristics of the sample under study. Analysing the descriptive statistics of the generic characteristics of the sample, it appears that, although the maximums indicate the presence of large companies in the sample, observing the average of the items of sales and total assets, it appears that most companies are small and medium-sized enterprises.

Table 9- Activity of companies present in the sample (in thousands of euros)

Characteristics of the sample	Mean	Standard Deviation	Minimum	Maximum
ASSETS	14 975.94	17 460.6	1000.078	$1.72 * 10^7$
PPE	3 287.60	4 8087.53	0.00	5 120 891.00
SALES	7 046.63	56 890.78	0.00	4 282 476
REC	1 593.42	10 171. 08	0.00	946 795
ROA	3.60%	0.30	-30.36	5.79
CFO	743.04	10665.56	-625 040.30	1 146 935
COGS	3 470.87	38 828.65	0.00	4 848 200

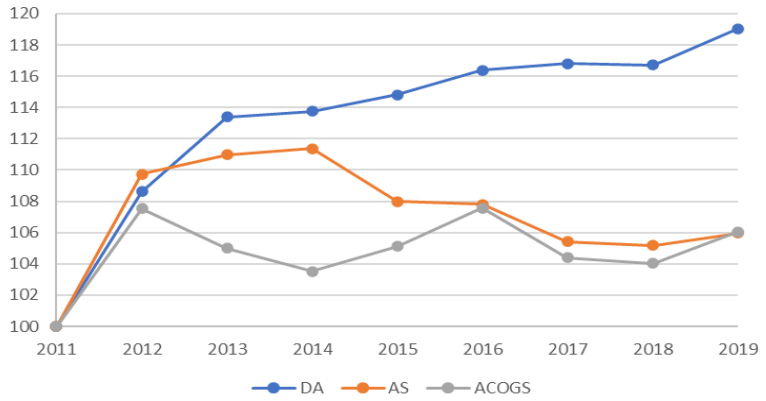
Note:

PEE- gross property, plant, and equipment; REC- net receivables; ROA- return on assets; CFO- cash flow from operations

4.3 Multivariate analysis

An exploratory analysis should examine the indicators' structure. Besides that, it should assess the data set suitability and explain the methodological choices, for example, weighting (Michela et al., 2008). There are many statistical analyses that can be performed, so it was chosen to use the most frequent ones, that is, descriptive statistics to describe the sample (already presented above) and Pearson's correlation to understand the relationships between the different proxies. Besides that, a lack of correlation in the principal variables is a valuable property. It suggests that the main variables are quantifying distinct "statistical dimensions" (Michela et al., 2008). The index disaggregated into the different proxies is shown below. Regarding discretionary manipulation, there is a decrease in its use reflected in the increase of quality. It was observed that there is a decrease in discretionary manipulation reflected in the increased proxy index. The manipulation of sales and cost of goods sold presents positive and negative variations.

Figure 2- Proxies Indexes



Year	2011	2012	2013	2014	2015	2016	2017	2018	2019
DA	100.00	108.62	113.39	113.77	114.80	116.40	116.81	116.73	119.03
AS	100.00	109.75	110.97	111.37	108.00	107.80	105.42	105.18	105.98
ACOGS	100.00	107.53	104.99	103.53	105.11	107.57	104.39	104.05	106.04

As previously stated, when creating an index, the correlations between the variables should not be strong as this may indicate that we are inserting the same phenomenon twice (Michela et al., 2008). It is used the Pearson correlation. Pearson correlation coefficient measures the degree of linear correlation between two quantitative variables. It is an index with values between -1.0 and 1.0 inclusive, which reflects the strength of a linear relationship between two sets of data (Michela et al., 2008). So, |0.9| indicates a very strong correlation.; |0.7| to |0.9| indicates a strong correlation; |0.5| to |0.7| indicates a moderate correlation; |0.3| to |0.5| indicates a weak correlation; 0 to |0.3| indicates a negligible correlation.

It should be noted that all correlations between the variables are moderate, thus, it was decided not to remove any variable. Below is the correlation matrix (using Pearson's correlation).

Table 9- Proxies' correlation matrix

	DA	AS	ACOGS
DA	1		
AS	0.42***	1	
ACOGS	0.58***	0.6104***	1

4.4 Fit and quality assessment of the proxies

Before proceeding to the concrete analysis of the results obtained, it is of utmost importance to assess whether the assumptions underlying the proxies used to measure the different EQ's dimension are fully met.

Typically, the least squares approach is used to fit linear regressions. When using least squares approach, it is necessary that variables present a multivariate normal distribution (Marôco, 2021). The validation of this assumption is carried out through the evaluation of measures of distribution form (asymmetry and kurtosis) of variables (Marôco, 2021). Besides that, the normal distribution presents asymmetry (sk) and kurtosis (ku) equal to zero. Thus, if variables present values close to zero, this assumption is validated. However, it is necessary to know which deviations from normality compromise the reliability of the conclusions. Thus, biased results are produced whenever $|sk| > 2$ and $|ku| > 7$ (Finney & DiStefano, 2006). So that this criterion can be maintained, the outliers were removed from the analysis.

To summarize the results obtained regarding the fulfilment of this assumption, Table 10 is presented, in which it is possible to verify that the values obtained for sk and ku do not indicate any violation of the normality assumption. To summarize the results obtained, regarding the fulfilment of this assumption, Table 10 is presented, it is possible to verify that the values obtained for sk and ku do not indicate any violation of the normality assumption.

Table 10- Assessment of normality

Variables	sk	ku
TA_t/A_{t-1}	0.022	6.907
CFO_t/A_{t-1}	0.374	5.638
$COGS_t/A_{t-1}$	1.917	6.561

Regarding the assumption of the absence of multicollinearity, it says that the independent variables cannot be strongly associated (Marôco, 2021). The assessment of multicollinearity should be carried out using the Variance Inflation Factor (VIF) or Tolerance

(O'brien, 2007). Thus, a VIF value greater than 5 or a Tolerance value less than 0.20 indicate the presence of possible problems with multicollinearity (O'brien, 2007). It is possible to see in table 11 that this assumption was fulfilled.

To understand the quality of the adjustment, the F-test and T-tests were used, as these are the most recurrent tests in a study of earnings management (e.g. P. M. Dechow et al., 2012; Dichev & Dechow, 2002; Kothari et al., 2005). In regression analysis, the F test produces a more general hypnotises test. Through its use, it is determined whether any of the independent variables in the model has explanatory power. Each independent variable can then be individually tested with the T test, and it can be assessed if they have explanatory power.

The coefficient of determination (R^2) was also used because it allows to measure how well the observed results are replicated by the model (e.g. P. M. Dechow et al., 2012; Dichev & Dechow, 2002; Kothari et al., 2005). It can vary between 0 and 1. However, it should be noted that $R^2 \approx 1$ does not mean that the regression model provides a good fit to the data, since the addition of a variable increases the coefficient (even if it has very little explanatory power over the response variable). Thus, when R^2 is close to 1 in certain models, it leads to misinterpretations of new observations or unreliable estimation of the expected value of the dependent variable (Fox, 1980). So, it was concluded that R^2 may not be a good indicator of the degree of fit of the model. Therefore, it is preferable to use the adjusted coefficient (R^2a) (Fox, 1980). Unlike the coefficient R^2, the adjusted coefficient of determination, does not always increase when anew variable is added. In fact, if variables with little explanatory power is added, it tends to decrease (Fox, 1980).

As previously mentioned, the models for the construction of the index variables were carried out in a cross-sectional approach (by year and by industry). In this sense, having used the 2 digits CAE, 63 industries were present in the analysis. Bearing in mind that 3 models were used, and that the analysis was done for nine years, 1 701 linear regressions were performed, and it is not possible to present a detailed analysis, thus, we opted for a generalized analysis of all regressions. Thus, the T-test, the F-test, and the R^2a of the general regressions for each model are presented.

In table 11, it is possible to see that the quality of the proxies fit presented some problems (in the first model there are variables without explanatory power and the R^2a is very low). However, it was decided to continue the research and not remove any company from the sample, being aware that the adjustment of the proxies was not ideal.

Table 11- Proxies assumption and quality summary

Jones model modified by Kothari, Leone and Wasley (2005)					
Independent Variables	T-test	F-test	R^2a	Tolerance	VIF
$1/A_{t-1}$	9.64*			0.998	1.00
$(\Delta REV_{i,t}-\Delta REC_{i,t}) /A_{t-1}$	-26.02*			0.997	1.00
$PPE_{i,t} /A_{t-1}$	1.49	301.06*	0.0079	0.997	1.00
$ROA_{i,t}$	21.5*			0.998	1.00
constant	-1.45			-	-
Sales manipulation model by Roychowdhury (2006)					
Independent Variables	T-test	F-Test	R^2a	Tolerance	VIF
$1/A_{t-1}$	-9.48*			0.905	1.10
S_t/A_{t-1}	68.62*	2650.20*	0.05	0.908	1.10
$\Delta S_t/A_{t-1}$	33.35*			0.996	1.00
constant	61.04*			-	-
Cost of Goods manipulation model by Roychowdhury (2006)					
Independent Variables	T-test	F-Test	R^2a	Tolerance	VIF
$1/A_{t-1}$	3.71*			0.996	1.00
S_t/A_{t-1}	465.61*	99999.00*	0.59	0.996	1.00
constant	-10.98*			-	-

*,**,***significance of 1%.5% and 10%, respectively

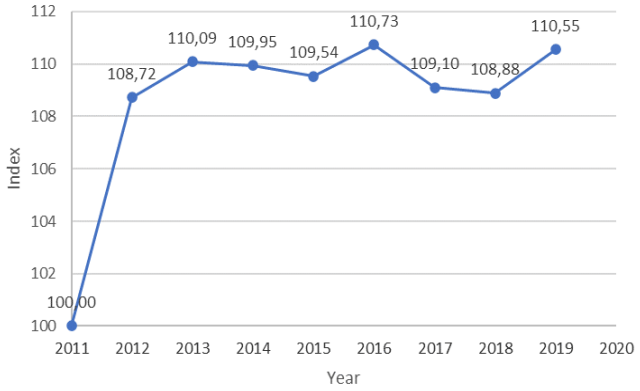
5. Presentation and analysis of results

At this point, the results obtained from the present investigation are presented and analysed. In a first phase, the EQ index is presented. Finally, the analysis of sensitivity and the relationship between EQ and economic cycle is shown.

5.1 Presentation and visualization of the EQ index

Next, the EQ index is presented in graph form and table form, as mentioned above.

Figure 3 - EQ Index



Year	2011	2012	2013	2014	2015	2016	2017	2018	2019
Index	100.00	108.72	110.09	109.95	109.54	110.73	109.10	108.88	110.55

Additionality, in order to understand the temporal evolution of the quality of financial information, it is important to study in detail the variation of the index. The table below shows the variation of the index over the nine years under analysis.

Table 12- Percentage variation of EQ Index

Year	2011	2012	2013	2014	2015	2016	2017	2018	2019
Variation	0.00%	8.72%	1.26%	-0.13%	-0.37%	1.09%	-1.48%	-0.20%	1.53%

Note that the greatest variation was in 2012, this variation may be related to the economic cycle, this analysis will be presented later. EQ increased until 2013. Then, there

was a slight deterioration in EQ until 2018 (except for 2016). Finally, in 2019 there was an increase in EQ compared to the homologous period.

5.2 Sensitivity analysis

A sensitivity analysis is a method that seeks to understand how much the result will be impacted if one of its variables is changed (Michela et al., 2008). This analysis is used to assess the robustness of an index because sometimes the index construction criteria are subjective and can be contested (Michela et al., 2008). In this sense, it was decided to change the weights to perform the sensitivity analysis.

Table 13- Scenarios (sensitivity analysis)

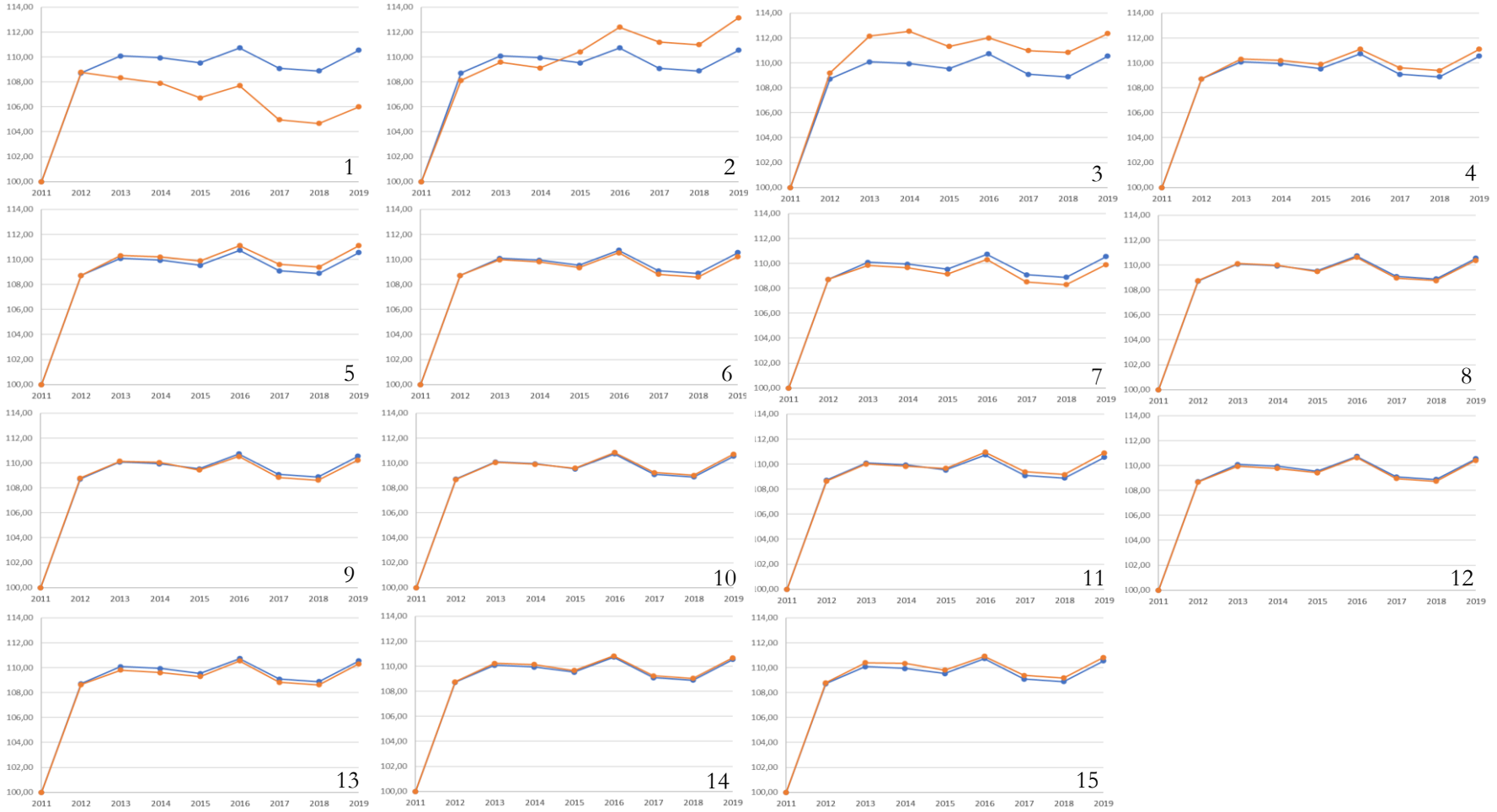
Description	Variable 1 (weight)	Variable 2 (weight)	Variable 3 (weight)
Scenario 1- Exclusion of DA	0	0.5	0.5
Scenario 2 Exclusion of AS	0.5	0	0.5
Scenario 3- Exclusion of ACOGS	0.5	0.5	0
Scenario 4- DA increased by 10%	0.3(3)	0.3(3)	0.3(3)
Scenario 5- DA increased by 20%	0.3(3)	0.3(3)	0.3(3)
Scenario 6- DA decreased by 10%	0.3(3)	0.3(3)	0.3(3)
Scenario 7- DA decreased by 20%	0.3(3)	0.3(3)	0.3(3)
Scenario 8- AS increased by 10%	0.3(3)	0.3(3)	0.3(3)
Scenario 9- AS increased by 20%	0.3(3)	0.3(3)	0.3(3)
Scenario 10- AS decreased by 10%	0.3(3)	0.3(3)	0.3(3)
Scenario 11- AS decreased by 20%	0.3(3)	0.3(3)	0.3(3)
Scenario 12- ACOGS increased by 10%	0.3(3)	0.3(3)	0.3(3)
Scenario 13- ACOGS increased by 20%	0.3(3)	0.3(3)	0.3(3)
Scenario 14- ACOGS decreased by 10%	0.3(3)	0.3(3)	0.3(3)
Scenario 15- ACOGS decreased by 20%	0.3(3)	0.3(3)	0.3(3)

On the next page, figure 4 is presented, which is the graphical representation of the scenarios presented in table 8

As it is possible to see in figure 4 when the proxies vary (DA, AS, ACOGS), there are no major differences in the index variation and its value (from scenario 4 to 15). However, the same does not happen when proxies are excluded. The most notable difference is when DA is excluded showing that this proxy has a greater influence on the index. Note that this may indicate that the choice of weights or the aggregation method may not have been the most suitable. Nevertheless, for this scenario, although more accentuated, the growth

trends are also similar to the EQ index (except for the year 2012). With regard to the exclusion of AS (scenario 2), the growth trends are also similar, with the exception of the transition from 2014 to 2015. Finally, regarding the exclusion of ACOGS (scenario 3), the trends for growth are similar to the EQ index growth trends, however, these are more prominent in the first two years.

Figure 4- Sensitise analysis

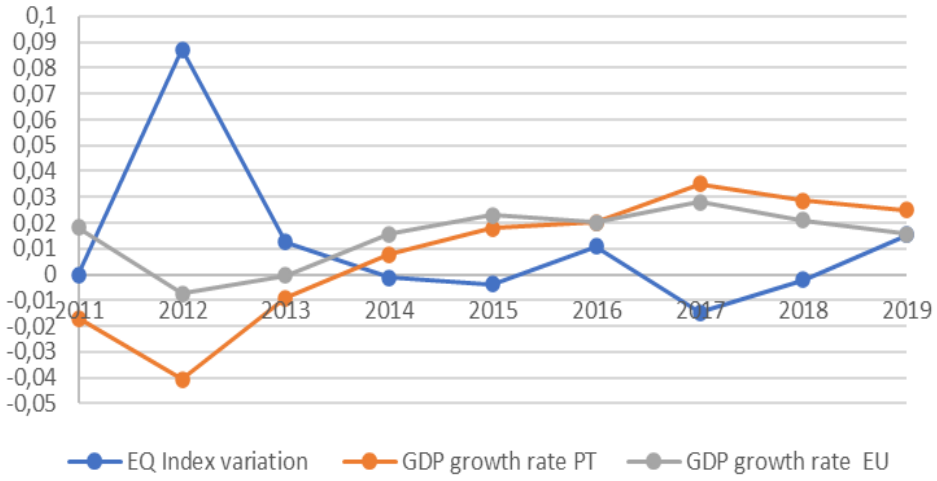


Note: The number in the graphics represents the scenarios shown in table 8. Note that the blue line represents the EQ Index and the orange line the scenarios.

5.3 Relationship between earning quality and the economic cycle

Considering that the objectives of this dissertation are to understand the temporal evolution of EQ and to understand EQ relationship with the economic cycle, the GDP growth rate was used as indicator of the economic cycle. So, firstly, it was decided to understand if there was a correlation between the variation of the EQ index and the GDP growth rate (both Portuguese and European).

Figure 5- Comparison between EQ index variation and GDP growth rate



Year	2011	2012	2013	2014	2015	2016	2017	2018	2019
EQ Index variation	0.00%	8.72%	1.26%	-0.13%	-0.37%	1.09%	-1.48%	-0.20%	1.53%
GDP growth rate PT	-1.70%	-4.06%	-0.92%	0.79%	1.79%	2.02%	3.51%	2.85%	2.49%
GDP growth rate EU	1.82%	-0.75%	-0.05%	1.57%	2.30%	2.00%	2.80%	2.11%	1.56%

Source: Pordata, European Economic Forecast and self-elaboration

By the graphic representation it was noticed that the growth trends were mostly opposite. So, first it was decided to study the correlations.

Table 14- Correlation matrix

	EQ Index variation	GDP growth rate PT	GDP growth rate EU
EQ Index variation	1		
GDP growth rate PT	-0.75**	1	
GDP growth rate EU	-0.84*	0.83*	1

*,**,***significance of 1%.5% and 10%, respectively

Both correlations are strong and significant, and the correlations are negative. That

is, EQ increases when the economic situation deteriorates (Cimini, 2014; Kousenidis et al., 2013; Zarowin, 2007). However, as mentioned above, correlation does not mean causality.

Besides that, it was developed 2 linear regressions. Linear regression analysis studies linear the relationship between the dependent variable and one or several independent variables. In this sense, relationships between the dependent and independent variables are calculated applying linear predictor functions and the unknown model parameters present in the function are estimated from the data.

The first one that studies the variation of the EQ index as a function of the European GDP growth rate:

Regression 1: Variation of EQ $Index_t = \beta_0 + \beta_1$*European GDP growth $rate_t + \varepsilon_t$

Where β = coefficient; ε_t = residuals and t= index that represents time

The second regression studies the variation of the EQ index as a function of the Portuguese GDP growth rate:

Regression 2: Variation of EQ $Index_t = \beta_0 + \beta_1$*Portuguese GDP growth $rate_t + \varepsilon_t$

Where β = coefficient; ε_t = residuals and t= index that represents time

Although not shown in this section, the assumptions of linear regression (linearity; homoscedasticity; independence and normality) were fulfilled. The results of the regression are presented in the following table.

Table 15- Regressions results

	Coefficient	Std. err.	t	P>|t|	R^2a	Prob > F
Regression 1					0.67	0.004
β_1	-2.20	0.53	-4.15	0.004		
β_0	0.044	0.001	4.54	0.003		
Regression 2					0.51	0.019
β_1	-0.90	0.298	-3.04	0.019		
β_0	0.018	0.007	2.50	0.041		

Thus, the relationship between the variation of the EQ index and both the Portu-

guese and European GDP is negative (taking into account the coefficients). For the case under study, it can be inferred that the economic cycle is negatively related to EQ, as in several studies (e.g. Cimini, 2014; Kousenidis et al., 2013; Zarowin, 2007). In the years under analysis, note that the biggest increase in the EQ was in 2012, the same year in which the GDP growth rate, both European and Portuguese, was the lowest.

Normally, the causality analysis is not done when studying the relationship between the economic cycle and the EQ (e.g. Cimini, 2014; Dutzi & Rausch, 2016; Kousenidis et al., 2013; Ming Chia et al., 2007; Zarowin, 2007). However, it is recommended in the index construction, that is, it must be understood if the index has a cause (Michela et al., 2008). Thus, it is proceeded to the study of causality using the Granger causality test. Test testing is based on two principles. First, the cause occurs before effect and cause has unique information about future values (Granger, 1969). Note that the test requires that the time series are stationary (Granger, 1969). The EQ index variation is a stationary time series, however, the same does not happen with the GDP growth rates. It was proceed knowing that there will be errors associated with the non-stationary data.

Granger causality test is a way of verifying whether a time series A helps to predict the other time series B(Granger, 1969). A time series A is said to Granger-cause B if it can be demonstrated, usually through a series of F-tests and T-tests on lagged values of A (and with lagged values of B also included), that those A values provide statistically significant information about future values of B (Granger, 1969). Besides that, as there is no a priori definition of which variables are endogenous or exogenous, in practice, it is carried out the causality tests in both directions, that is, if A causes B and if B causes A (Granger, 1969). Note that the null hypothesis will be that there is no causality, thus, when the p-value is smaller than 5%, the null hypothesis can be rejected

H1: The variation of the EQ index is caused by the Portuguese GDP growth rate

H2: Portuguese GDP growth rate is caused by the variation of the EQ index.

H3: The variation of the EQ index is caused by the European GDP growth rate

H4: European GDP growth rate is caused by the variation of the EQ index.

Afterwards, the Granger causality test validated H0, that is, the EQ index is caused by the Portuguese GDP growth rate, as it can be seen in the following table

Table 16- Results of the causality test

	F-test	p-value
H1	13,44	0,10%
H2	3,79	15,00%
H3	2,52	28,00%
H4	0,12	94,00%

Thus, it can be concluded that the Portuguese GDP growth rate helps to predict the other EQ index variation.

6. Conclusions, limitations, and future research

The relevance of the present investigation arises from the fact most studies measured EQ through a single variable, often through the discretionary accruals. However, it is known that the EQ is a multidimensional concept as its quantification depends on more than one variable. In addition, different studies have reached different conclusions regarding the temporal evolution of EQ. In this sense, and taking advantage of this theoretical gap, the main objective of this dissertation was defined as the construction of an index using the combination of different proxies to measure the EQ with greater robustness and security. To pursue the objective of the study, it was resorted to 3 dimensions of EQ, the DA, AS, ACOGS. In addition, understanding the relationship between the economic cycle and EQ was also one of the main objectives since there were studies with opposite results.

Thus, it can be concluded that the temporal evolution of the EQ is negatively correlated with both the Portuguese and European economic situation, meeting what several studies pointed out (e.g. Cimini, 2014; Kousenidis et al., 2013; Zarowin, 2007) . Thus, this dissertation also reinforces the idea showing that there may be more incentives to manipulate earnings in phases of economic growth.

Regarding the sample size, the present investigation brings to the results a vast robustness and security, as its size makes the sample under study quite heterogeneous, in terms of years under study and in terms of the various business activities represented. However, it appears that most companies are small and medium-sized enterprises, and this can be a limitation, large companies may not resort to manipulation in the same way.

Furthermore, it is concluded that there is a causal relationship between the business cycle and EQ. However, there is a limitation that the growth rate data are not stationary, as well as the limitations of the test used.

Besides that, regarding possible limitations of the reseach, in addition to the limitations arising from the assumptions made to reach the final objective, the study has associated all the limitations arising from the methodology used. In particular, indexes have as a major limitation the definition of weights and aggregation method, as the method used and the weights can be contested (Michela et al., 2008). In addition, another limitation is that the

proxies used do not have the desired explanatory power. It should be noted that not all dimensions of the EQ were included in the construction of the index. Finally, note that the imputation method has not been tested.

In order to avoid some of the limitations described above, it is proposed for future investigations to add new variables that measure different dimensions of the EQ to the analysis model. In addition, a less generalized analysis is suggested to understand the temporal evolution of the EQ in each industry. A more detailed analysis can also be done considering other properties, for example, understanding the temporal evolution taking into account the size of companies. Furthermore, comparing the results obtained with the sample of Portuguese companies with others countries would provide a different perception of the EQ evolution overtime. It is also important to emphasize that other aggregation methods (such as structural equations modelling) may be used, carrying out a sensitivity analysis to understand the quality of the method. Besides that, in the dissertation nothing was mentioned regarding the quality of the imputation method, so in the future, it should be tested and replaced if needed.

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