« Omni autem, cui multum datum est, multum quaeretur ab eo ; et cui commendaverunt multum, plus petent ab eo”.[1]

Lc, 12:48b

[1] "From everyone who has been given much, much will be demanded; and from the one who has been entrusted with much, much more will be asked" (Luke12:48b).

Acknowledgements

There are lots of people to whom I would like to thank for a huge variety of reasons. These people will always be very special to me because they have helped me carry out this PhD project. As a consequence, it is a great pleasure to me to thank them here and to acknowledge their input into this project. I may forget to mention some, but I would like to say thank you to…

First and foremost, I wish to express my gratitude to my supervisors, Professor Ana Maria Rodrigues and Professor Natália Canadas. Their wise counsel, determination, friendship and encouragement have been an essential inspiration throughout the work. Especially, I want to thank Professor Natália Canadas for suggesting the theoretical contribution of my work centred on a new earnings quality perspective based on the virtuosities of the residual income model.

I cannot overstate my thanks to Professor António Alberto Santos (Faculty of Economy of the University of Coimbra - FEUC) for his powerful help in models estimations. I owe a great debt of gratitude to him for his guidance and encouragement during the thesis development. His experience in Econometric has been a valuable contribution to my work.

I am also very grateful to Micael Couceiro (coordinator of the *RoboCorp* multidisciplinary group at the Engineering Institute of Coimbra – ISEC) for his wonderful help in handling MATLAB codes and for his friendship.

I also would like to thank Professor Pedro Bação (Faculty of Economy of the University of Coimbra - FEUC) for his important help in some GRETL code developments.

I would also like to manifest my satisfaction for having participated in the Doctoral Colloquium of European Accounting Association (EAA) in 2008, at Erasmus University Rotterdam, organised in collaboration with the European Institute for Advanced Studies in Management (EIASM). Especially, I would like to thank Professors Peter Pope (University of

Lancaster), Wayne Landsman (University of North Carolina) and Cristian Leuz (University of Chicago) for the valuable comments on my work and for their helpful feedback. I would also like to thank the colleagues for the support that they gave me and for the opportunity to build new friendships, namely with Patricia Bachiller (Spain), Maria Tsipouridou (Greece), Paola Madini (Italy) and Radhika Lunawat (EUA).

I also benefited helpful comments from the workshop participants at:

- 5th Workshop on Accounting and Regulation, September 2010, held in Siena, Italy;
- VII Workshop on Empirical Research in Financial Accounting and III Research Forum of the Spanish Journal of Finance and Accounting, November 2009, in Cartagena, Spain;
- IX and VII Seminário Anual do GRUDIS, Rede Portuguesa de Investigação em Contabilidade (2010 and 2008), in Covilhã, Universidade da Beira Interior, and in Lisboa, ISCTE Business School, respectively. Heartfelt thanks are given to Professor José António Moreira (Faculty of Economy of the University of Porto - FEP) for his insightful comments in GRUDIS workshops.
- 31st Annual Congress of the European Accounting Association 2008, in Rotterdam, The Netherlands.

To Cristina Nunes, my English teacher and my great friend, who always prepared me very well and encouraged me for all international conferences and research meetings and carefully read and corrected all my works.

To all my dear friends, who constantly supported, encouraged and understood me and, above all, loved me:

- Teresa Eugénio, Tânia Santos, Sónia Santos, Paula Órfão, Carla Fernandes, Padre Nuno Santos, Padre Pedro Freitas.
- To my friends from my “Comunidade de Vida Cristã” (CVX): Ana Faure, António Valério, Bruno Maricato, Eduardo Matos, Inês Miranda-Santos, Inácio Semedo, Marta Neves, Paula Melo, Sónia Figueiredo.
- To my friends from my group of “Fé e Razão na Academia” (FRA): Filipe Coreta Gomes, Inês Miranda-Santos, João Gonçalo Frade, Jorge Bernardino, Lucinda Silva Dias, Nicolás Lori, Padre Nuno Santos, Rui Vilão.

- To my colleagues at School of Technology and Management of the Polytechnic Institute of Leiria, namely Departament of Management and Economics.
- To my colleagues from the Faculty of Economy at University of Coimbra: Susana Jorge, Isabel Cruz and Ilídio Lopes.

Some of the friends mentioned above have a very strong impact on my life especially in the last year of my PhD project. To all of you, thank you very much!

Sincere thanks are given to all Executive Mayor of Condeixa-a-Nova, Mayor and fellow council members, to which I belong since 2009, for believing in me, their enthusiasm, encouragement and patience, thank you for waiting for a greater willingness on my part while completing this PhD project.

I acknowledge financial support from the grants of Portuguese Ministry of Science and Technology, Fundação para a Ciência e Tecnologia (FCT), QREN - POPH - Typology 4.1 - Formação Avançada (SFRH / BD / 37689 / 2007) and from the School of Technology and Management of the Polytechnic Institute of Leiria.

Finally, I want to thank to my dearest parents and my sister. I am forever grateful for their understanding, endless patience and encouragement when it was most needed. I cannot find comparison for your love, care and dedication.

And to God, who planted in me a dream now materialized, who has always been with me throughout my journey, by giving me strength when I had none, and who inspired me to move on.

To my parents and sister: Delfina, José and Mariana.

Abstract

The quality of earnings is a summary metric in performance evaluation and a focal question to assess the quality of accounting information. A high-quality earnings number will reflect current operating performance, being a good indicator of future operating performance, and it accurately annuitizes the intrinsic value of the firm. The multidimensional nature of the earnings quality (EQ) concept has given form to a multiplicity of constructs and measures.

The objective of the thesis is to provide a better and deeper understanding of the vectors of analysis in what concerns the dimensions of EQ concept, constructs and measures. We consider the multidimensional nature of the concept and highlight a "new" earnings quality perspective taking in account the virtuosities of the residual income model. It is proposed a empirical model which reinterprets rebuilding the linear information dynamics in relation to market value added and captures, in a composite measure, the tridimensional dimension of the EQ concept: persistence, predictability and informativeness of earnings.

Our key findings are:

- Imposing linear information structure, our proposed model provide a composite measure of EQ that captures the persistence, predictability and informativeness of earnings. Nonetheless, informativeness of earnings seems to capture *per si* all the relevant value information of earnings;
- The valuation coefficient of net income differs from that of total accruals, and those of the four major accruals components differ from each other. These findings suggest that disaggregation of earnings into cash flow and total accruals, and total accruals into its major components aid in predicting market value added.
- Predictions errors differ significantly when the linear information model (LIM) is imposed.
- Our findings support the efficacy of drawing inferences from valuation equations based on residual income models that do not impose the structure implied by the model;
- The magnitudes of the valuation parameter estimates and the values of adjusted R^2 are better performed when we consider only positive earnings. So, it seems that loss cases have a dampening effect on the measures of the information content of earnings. They have a much weaker association with returns than profit cases.

Performing a separate industry estimation according to the system of equations for each earnings components (accruals and cash flows), we provide evidence that:

- Informativeness of earnings is significantly higher in portfolios of industries with high earnings quality (high persistence of abnormal earnings and low (high) predictability of accruals (cash flows)) compared to portfolios of industries with low earnings quality (low persistence of abnormal earnings and high (low) predictability of accruals (cash flows));
- Explanatory power of earnings to explain market value added is significantly higher in portfolios of industries with high earnings quality (high persistence of abnormal earnings and low (high) predictability of accruals (cash flows)) compared to portfolios of industries with low earnings quality (low persistence of abnormal earnings and high (low) predictability of accruals (cash flows)).

The results of the development of a measure instrument that allows to delimitate the basic constructs and measures of the EQ concept, through the application of an exploratory multivariate techniques analysis, namely, the factor analysis of principal components suggest six different dimensions of earnings quality: (1) time-series properties (persistence and predictability); (2) relevance; (3) accruals quality; (4) informativeness of earnings; (5) smothness and (6) timeliness.

Keywords: Earnings quality; valuation; market value added; linear information models; persistence; predictability; relevance; accruals quality; informativeness; smoothness; timeliness.

Resumo

A qualidade dos resultados é uma medida sumária de avaliação do desempenho e um aspecto fulcral quando se pretende avaliar a qualidade da informação contabilística. Resultados de elevada qualidade reflectem o desempenho operacional do negócio, são bons indicadores de resultados futuros e conduzem a uma apreciação mais correcta do valor intrínseco da empresa. A natureza multidimensional da qualidade dos resultados tem dado forma a uma multiplicidade de constructos e medidas de análise.

O objectivo desta tese consiste em fornecer uma melhor e mais profunda compreensão dos vectores de análise no que diz respeito às dimensões do conceito de qualidade dos resultados, constructos e medidas. Consideramos a natureza multidimensional do conceito e salientamos uma "nova" perspectiva da qualidade dos resultados que atende às virtuosidades do modelo de rendimento residual. Propõe-se um modelo empírico que reinterpreta a dinâmica de informação linear em relação ao valor acrescentado pelo mercado e capta, numa medida compósita, a dimensão tridimensional do conceito de qualidade dos resultados: persistência, predictabilidade e conteúdo informativo dos mesmos.

As nossas principais conclusões são:

- Através da imposição da estrutura da dinâmica de informação linear, o nosso modelo fornece uma medida compósita da qualidade dos resultados que capta a persistência, a predictabilidade e o conteúdo informativo dos resultados. No entanto, o conteúdo informativo dos resultados parece fornecer *por si só* toda a informação relevante da qualidade dos resultados;
- O coeficiente de avaliação do resultado líquido difere do coeficiente dos *accruals* totais, e dos coeficientes das quatro componentes principais dos *accruals* totais. Esta constatação sugere que a desagregação dos resultados nas suas principais componentes, fluxos de tesouraria e *accruals* totais, e a desagregação dos *accruals* totais nas suas quatro principais componentes, permite uma melhor previsão do valor acrescentado pelo mercado;
- Os erros de previsão diferem significativamente quando o modelo de informação linear é imposto.
- Os nossos resultados corroboram a eficácia de realizar inferências estatísticas a partir de equações de avaliação baseadas no modelo de rendimento residual que não impõem a estrutura implícita no modelo.

- Os valores dos coeficientes das diferentes variáveis estimadas e o valor do R^2 ajustado têm um melhor desempenho quando consideramos apenas os anos de resultados positivos (lucros). Assim, constatámos que os casos de prejuízos parecem ter um efeito descendente sobre o conteúdo informativo dos resultados.

Os resultados obtidos com a estimação por indústria dos sistemas de equações para cada componente dos resultados considerados individualmente, *accruals* totais e fluxos de caixa, indicam que:

- O conteúdo informativo dos resultados é significativamente mais elevado em portfolios de indústrias com elevada qualidade dos resultados (elevada persistência dos resultados supranormais e baixa (alta) predictabilidade dos *accruals* (fluxos de caixa)) comparado com portfolios de indústrias com baixa qualidade dos resultados (baixa persistência dos resultados supranormais e alta (baixa) predictabilidade dos *accruals* (fluxos de caixa));
- O poder explicativo dos resultados para explicar o valor acrescentado pelo mercado é significativamente mais elevado em portfolios de indústrias com elevada qualidade dos resultados (elevada persistência dos resultados supranormais e baixa (alta) predictabilidade dos *accruals* (fluxos de caixa)) comparados com portfolios de indústrias com baixa qualidade dos resultados (baixa persistência dos resultados supranormais e alta (baixa) predictabilidade dos *accruals* (fluxos de caixa)).

Os resultados do desenvolvimento de um instrumento de medida que permite delimitar os constructos básicos e as medidas do conceito da qualidade dos resultados, através da aplicação de uma técnica de análise exploratória multivariada, ou seja, a análise factorial de componentes principais, sugere seis diferentes dimensões da qualidade dos resultados: (1) propriedade das séries temporais (persistência e predictabilidade); (2) relevância; (3) qualidade dos *accruals*; (4) conteúdo informativo dos resultados; (5) alisamento dos resultados; (6) tempestividade.

Palavras chave: Qualidade dos resultados; avaliação; valor acrescentado pelo mercado; modelos de informação linear; persistência; predictabilidade; relevância; qualidade dos *accruals*; conteúdo informativos dos resultados; alisamento dos resultados; tempestividade.

Contents

List of tables

List of figures

List of acronyms

AICPA	American Institute of Certified Public Accountants
AIMR	Association for Investment Management and Research
BLUE	Best Linear Unbiased Estimators
EB	Edwards-Bell Model
ECM	Error Components Model
EQ	Earnings Quality
EPS	Earnings Per Share
ERC	Earnings Response Coefficient
EU	European Union
FASB	Financial Accounting Standard Board
FEM	Fixed Effects Model
GLS	Generalized Least Squares
GRETL	Gnu Regression, Econometrics and Time-series Library
IAS	International Accounting Standard(s)
IASB	International Accounting Standard Board
IASC	International Accounting Standard Committee
IFAC	International Federation of Accountants
IFRS	International Financial Reporting Standard(s)
LIM	Linear Information Model
LSDV	Least Squares Dummy Variables
MATLAB	Matrix Laboratory
OLS	Ordinary Least Squares
PASW Statistics	Statistical Package for Social Science
PER	Price Earnings Ratio
PVED	Present Value of Future Expected Dividends
REM	Random Effects Model
RI	Residual Income
RIV	Residual Income Valuation Model
ROA	Return on Assets
ROE	Return On Equity
SEC	Securities and Exchange Commission
VIF	Variance Inflaction Factors

"The important thing is never stop questioning."
Albert Einstein

"We only know exactly when we know little; as we acquire knowledge, questioning settles."
Johann Wolfgang von Goethe

"A journey of a thousand miles always begins with the first step."
Confúcio

INTRODUCTION

1 - Background and motivation

The firm performance evaluation has always been a present theme, both in research and in practice. The objectives of financial analysis are to evaluate the firm performance, to assess the extent to which current performance is indicative of future performance, and based on this analysis, to determine whether the current stock price reflects intrinsic firm value. In this context, earnings quality is a focal question when it comes to assess the quality of accounting information and financial reporting. Earnings are used as a summary measure of the firm performance by a large variety of users (Dechow, 1994). Therefore, earnings are the metric in performance evaluation, and, what is more, the earnings quality is a fundamental condition for market efficiency and transparency.

From this perspective, a high-quality earnings number is one that accurately reflects the company's current operating performance, is a good indicator of future operating performance, and is a useful summary measure for assessing firm value (Dechow and Schrand, 2004).

The firm performance depends on its ability to create value, that is to say its ability to generate future cash flows. Thus, the difficulty in firm performance evaluation lies in the establishment of predictions about future performance.

The information about performance such as on earnings and its components is a primary focus of financial reporting (FASB, 1978 § 43 and 44). The same is requested, namely, to appreciate the potential variations in the resources that the company may control in the future (IASC, 1989 § 17). In this context, such information is supplied by accrual accounting (FASB, 1978 and IASC, 1989). The investors, creditors and other users use such information, or for IASB (IASC, 1989), the information about the performance variability, as a basis to appreciate the enterprise capacity to generate cash flows from its base of resources.

The centrality of this objective is embedded in the following statements from the FASB (1978 § 43): “The primary focus of financial reporting is information about an enterprise’s performance provided by measures of earnings and its components. Investors, creditors, and others who are concerned with assessing the prospects for enterprise net cash inflows are especially interested in that information. Their interest in an enterprise’s future cash flows and its ability to generate favourable cash flows leads primarily to an interest in information about its earnings (...)”.

Earnings quality and the quality of financial reporting in general are receiving more and more attention and are in the centre of the debate for investors, regulators as well as researchers. This heightened attention to the subjects of earnings quality is in part due to the wave of accounting scandals of the early 2000s (manipulation of accounting numbers) and the post-2008 crises.

In the literature, the use of “earnings quality” and “earnings management” with similar but with opposite meaning tends to be common, so, we use these two concepts indistinctively throughout this thesis. The assumption made in the literature of a negative relationship between earnings management and earnings quality implies that the measures adopted to detect earnings management also tend to be used to detect earnings quality (*e.g.*, Wysocki, 2006; Schipper and Vicent, 2003).

The subject of earnings quality is a complex area and no researcher has this far been able to provide a unique definition of earnings quality, neither an adequate measure for it has been found. There are various measures and constructs of earnings quality in literature capturing diverse manifestations of earnings quality (Balsam *et al*., 2003): the multidimensional nature of the earnings quality concept. The aspects often discussed are the persistence, the predictability, the informativeness of earnings[2] and earnings management.

2 - Purpose and research method

The main objectives of this thesis are to provide a better and deeper understanding of the vectors of analysis in what concerns the dimensions of earnings quality concept, constructs and measures, considering its multidimensional nature and to propose a "new" earnings quality perspective taking into account the virtuosities of the residual income model.

To do that, we will retain **three strands of analysis**.

Concerning the **first strand** (chapters 1, 2 and 3), which are our background stand of analysis, we have the following main purposes:

- To identify in the literature the different earnings quality (EQ) definitions and to explore the relevant studies about the relationship between financial statement data and firm value, taking into account the assessment of earnings quality and its implications for firm value.
- To propose a "new" earnings quality perspective, which means a "new" link between the three earnings quality constructs, persistence, predictability and informativeness, based on the virtuosities of the residual income model adopted by Ohlson (1995) and its subsequent refinements by Feltham and Ohlson (1995) and Ohlson (1999), knowing that earnings are important for evaluation effects and the investors see in earnings a valuable information source to assess the firm value. In fact, the quality of accounting information is a function of its relevance – a function of its predictability, informativeness and confirmatory value.

  Information has predictive value if it has value (high quality) as an input to the predictive processes, that is if it is used by investors to form their own expectations about the future. In this sense, earnings quality concept is a way to

[2] In an empirical way, we define "earnings" as "net income" and we use the terms interchangeably.

assess the relevance, the reliability of earnings, in short, the informativeness of earnings, in terms of value relevance.

In this "new" earnings quality perspective, we redesign the linear information model (LIM) structure of accounting information in relation to the market value added[3] and taking to account the earnings quality concept.

- To identify in the literature the different vectors of analysis, constructs and measures, concerning to its multidimensional nature;

Regarding the **second strand of analysis** (chapters 4 and 5), our main purpose relies on:

A) To test empirically our linear information model (LIM) redesigned in order to analyze:
   - Whether imposing linear information structure is important to draw inferences from valuation equations based on residual income models;
   - And whether imposing linear information model (LIM) provides a composite measure of earnings quality that simultaneously captures the persistence, the predictability and the informativeness of earnings (chapter 4), that is, a composite and tridimensional measure of earnings quality.

   In this second strand of analysis (chapter 4), we also considered the convexity of earnings value and we tested if the information content of the composite measure of earnings quality is higher when avoiding the dampening effect of loss cases.

B) Taking into account that it is expected that accruals and cash flows components of earnings have different ability to predict future abnormal earnings, different persistence, different predictability and different valuation implications, we

[3] Market value added ($Dif_{MBV} = MVE_{it} - BVE_{it}$) is the difference between the current market and book values of common equity. If Dif_{MBV} is positive, the firm has added value. If it is negative, the firm has destroyed value. Market value added is a proxy for goodwill or "unrecorded goodwill", as it is known in the work of Feltham and Ohlson (1995).

perform separate industry estimation (chapter 5), according to the system of equations for each earnings components (accruals and cash flows), and we test empirically whether:

- Informativeness of earnings is significantly higher in portfolios of industries with high earnings quality (high persistence of abnormal earnings and low (high) predictability of accruals (cash flows)) compared to industries with low earnings quality (low persistence of abnormal earnings and high (low) predictability of accruals (cash flows));
- Explanatory power of earnings to explain market value added is significantly higher in portfolios of industries with high earnings quality (high persistence of abnormal earnings and low (high) predictability of accruals (cash flows)) compared to industries with low earnings quality (low persistence of abnormal earnings and high (low) predictability of accruals (cash flows));

Regarding the **third strand of analysis** (chapter 6), and considering that earnings quality concept is difficult to define, there is no definitive criteria to evaluate it, it has a multidimensional nature which gives form to a large multiplicity of measures and constructs that have been used to approach the earnings quality, the main purpose relies on the development of a measure instrument that allows to delimitate the basic constructs and measures of the earnings quality (EQ) concept, reviewed in chapter 3, through the application of exploratory multivariate analysis, namely, factor analysis of principal components. Factor analysis of principal components allows us to obtain a set of main factors or underlying dimensions of earnings quality. Factor analysis is a data reduction technique to research interdependencies. By factor analysis we mean the study of interrelationships between the variables in an effort to find a new set of variables, fewer in number than the original set of variables, which express what is common to the original variables. Thus, whenever we use the term factor analysis we are strictly speaking about those techniques that distinguish different types of variance. Similarly, whenever we use the term factors or underlying dimensions we are referring to factors that only represent common or shared variation.

3 - Sample and methodology

To achieve our objectives an extensive literature review is conducted and three empirical studies are completed. Our sample consists of all domestic listed firms from 11 European countries[4] that are required to prepare consolidated financial statements.

We obtained data for the 1990-2009 period from the *Thomson Datastream and WorldScope – Global Research Annual Industrial Files*. All companies were selected based on the information available in the database.

A positive approach is adopted, using data analysis based on panel data estimation (ordinary least squares – *pooled regression*, fixed effects and random effects) and factor analysis of principal components.

We use four different softwares to analyze data: *MATLAB – version R2009b (Matrix Laboratory)*[5], *GRETL – version MS Windows (Gnu Regression, Econometric and Time-series Library)*[6], *PASW Statistics – version 18 (Statistical Package for the Social Sciences*[7]*)* and *R Software – version R-2.13.2*[8].

[4] The eleven Europen countries considered in our sample are: Belgium, France, Greece, Holland, Ireland, Italy, Lithuania, Portugal, Romania, Spain and United Kingdom. Our sample is made in agreement with firms based on code law countries and common law countries. Based on previous studies (*e.g.*, Hail and Leuz, 2007; Barth *et al.*, 2008; Isidro and Cabrita, 2008; Landsman *et al.*, 2009; Chen *et al.*, 2009), the group of code law countries are constituted by Belgium, France, Greece, Holland, Italy, Lithuania, Portugal, Romania and Spain. Countries that are part of the common law are the United Kingdom and Ireland. We intend to test empirically, in future research, if there is a different impact on information content of annual earnings in code law countries as opposed to the common law countries.

[5] The name MATLAB stands for *matrix laboratory*. The MATLAB high-performance language for technical computing integrates computation, visualization, and programming in an easy-to-use environment where problems and solutions are expressed in familiar mathematical notation.Typical uses include: math and computation, algorithm development, data acquisition, modeling, simulation and prototyping, data analysis, exploration and visualization, scientific and engineering graphics.

[6] GRETL is an acronym for Gnu Regression, Econometrics and Time-series Library. It is a software package for doing economterics that is easy to use and reasonably powerful, including a shared library, a command-line client program and a graphical user interface. GRETL can be used to compute least-squares, weighted least squares, nonlinear least squares, instrumental variables least squres, logit, probit, tobit and a number of time series estimators. GRETL uses a separate Gnu program called ***gnuplot*** to generate graphs and is capable of generating output in LaTeX format.

[7] SPSS is a Package for the Social Sciences. SPSS is among the most widely used programs for statistical analysis in social science. Statistics included in the base software: descriptive statistics, bivariate statistics, prediction for numerical outcomes and prediction for identifying groups (factor analysis, cluster analysis and discriminant analysis).

4 – Contributions

This thesis provides an understanding of the vectors of analysis in what concerns the dimensions of earnings quality concept, constructs and measures, according to the multidimensional nature of the concept.

At a theoretical level, this thesis adds a new link between the three perspectives of earnings quality: persistence, predictability and informativeness, based on the residual income model. Highlightening the virtuosities of the residual income model, we propose a "new" earnings quality perspective, focusing our analysis in the link between contemporaneous and future earnings, in line with the linear information dynamics (Ohlson, 1995; Feltham and Ohlson, 1995; Ohlson, 1999; Barth *et al.*, 1999 and 2005). We reinterpret rebuilding this link considering the tridimensional dimension of the earnings quality concept: persistence, predictability and informativeness.

The link between accounting and contemporaneous equity values have been extensively studied. Nevertheless, no study, to our knowledge, has tested whether and to what extent disaggregating earnings, imposing linear information structure of accounting numbers, aid in predicting contemporaneous market value added and provide a composite measure of earnings quality (EQ) that simultaneously captures the persistence, the predictability and the informativeness of earnings[9].

At the empirical level and taking into account the multidimensional nature of the earnings quality concept, we operationalized a large multiplicity of measures and constructs through the application of factor analysis in order to obtain a *score*, which means, a measure instrument that delimitates the basic constructs and measures of

[8] R Software is a language and environment for statistical computing and graphics. R Software provides a wide variety of statistical (linear and nonlinear modeling, classical statistical tests, time-series analysis, classification, clustering) and graphical techniques, and is highly extensible.

[9] At the empirical level, and in order to test empiricaly whether imposing linear information structure is important to draw inferences from valuation equations based on residual income models, we needed to use a specific software of mathematical programming in order to develop the algebraic relation between the valuation coefficients and the forecasting equation coefficients for linear information model (LIM) structure with the disaggregation of earnings into cash flow and total accruals into its four major components. We used the *MATLAB* Software, this software allows us to solve many technical computing problems, especially those with matrix and vector formulations.

earnings quality concept. To our knowledge, this is the first study that operationalizes simultaneously a large diversity of constructs and measures used to assess the earnings quality concept.

5 – Structure

There are six further chapters. The review of relevant literature is conducted in chapters 1 and 3. In these chapters, we indicate different definitions on earnings quality present in the literature and we provide a better and deeper understanding of the dimensions of earnings quality concept, constructs and measures, considerin the multidimensional nature of the concept. We classify the dimensions of earnings quality in three categories: earnings quality constructs that derive from (1) the time-series properties of earnings; (2) the accruals quality; (3) selected qualitative characteristics in the conceptual framework of the IASB/FASB.

In chapter 2, we propose a “new” earnings quality perspective based on our proposed empirical model, which reinterprets rebuilding the linear information dynamics in relation to the market value added and captures, in a composite measure, the three earnings quality constructs: persistence, predictability and informativeness of earnings.

In the empirical part of the thesis (chapters 4 to 6), three different studies are presented.

In chapter 4, we test whether:

– Imposing our linear information model (LIM) structure is important to draw inferences from valuation equations based on residual income models;
– Imposing LIM, contemporaneous market value added provides a composite measure of earnings quality (EQ) that simultaneously captures the persistence, the predictability and the informativeness of earnings;
– Disaggregating earnings into cash flow and total accruals (or in the major components of accruals) results in different predictive ability of accounting numbers towards market value added;
– The information content of the composite measure of earnings quality is higher when the dampening effect of losses cases is avoided.

In chapter 5, with a system of equations, for each earnings components (accruals system and cash flows system), we assess, in separate industry estimation, whether informativeness of earnings are significantly higher in portfolios of industries with high earnings quality (high persistence of abnormal earnings and low (high) predictability of accruals (cash flows)) compared to industries with low earnings quality (low persistence of abnormal earnings and high (low) predictability of accruals (cash flows)). And whether explanatory power of earnings to explain market value added is significantly higher in portfolios of industries with high earnings quality (high persistence of abnormal earnings and low (high) predictability of accruals (cash flows)) compared to firms with low earnings quality (low persistence of abnormal earnings and high (low) predictability of accruals (cash flows)).

Chapter 6 presents our last empirical study (third empirical study). Taking into account that earnings quality concept has a multidimensional nature which gives form to a large multiplicity of measures and constructs presented in chapter 3, we develop a measure instrument that allows to delimitate the basic dimensions of the earnings quality concept trough the application of an exploratory multivariate analysis, namely, factor analysis of principal components. We operationalize empirically the different measures and constructs and we provide a *score* for the earnings quality.

Finally, the conclusion contains an overview of research goals, principal results, and contributions of the study. It reflects on the outcomes of the thesis in respect to the main objectives, based on third strand of analysis, outlined in the introduction. Contributions are assessed in terms of the enhancement of theoretical understandings and their practical contributions. Some limitations of the thesis and some suggestions for further research are presented.

Chapter 1

Earnings Quality and Valuation

1.1. Introduction

The subject of earnings quality is a complex area and no researcher has this far been able to provide a unique definition of earnings quality, neither to find an adequate measure for it.

However, in general, all agree that earnings quality is a summary measure in performance evaluation and a focal question to assess the quality of accounting information. A high-quality earnings number will reflect current operating performance, being a good indicator of future operating performance, and is a useful summary measure for assessing firm value. But, determining earnings quality and its implications for firm value is complex.

Valuation models based on earnings, and based on book value, are viewed typically as an alternative approach to assess the firm value. The use of earnings in various valuation models can be theoretically justified. The higher earnings quality, the more useful the earnings data as a forecasting metric and the more accurate the valuation. Ohlson's (1995) model offers a formal link between valuation and accounting numbers and it is cited frequently as the theoretical foundation of such research.

This chapter explores the different earnings quality definitions and presents the relevant literature on studies about the relationship between financial statement data and firm value, namely, Ohlson (1995), Feltham and Ohlson (1995) and Ohlson (1999).

1.2. Defining earnings quality

Many studies give a definition on earnings quality. All of them agree that the concept is complex and nebulous, there is not a unique definition, neither an adequate measure for it. Although the concept is of common use, there is no consensus between academics and practitioners on its content, that is, there is no single definition of earnings quality. In fact, as mentioned, namely, by Bernstein (1996: 749) “virtually there is no general agreement as regard to the definitions or assumptions on this term (earnings quality)”. Or, as stated by Ghosh *et al.* (2005: 34) “the earnings quality is a nebulous concept”.

Earnings are of high quality when the earnings number accurately annuitizes the intrinsic value of the firm. Such earnings are referred to as “permanent earnings” in the accounting literature (*e.g.*, Black, 1980; Beaver, 1998; Ohlson and Zhang, 1998).

Beaver (1999: 41) says that “earnings are of high quality if they are sustainable”, thus they are a good indicator of future earnings. Or, according to Penman and Zhang (2002: 237), “earnings can be regarded as good quality if it is a good indicator of future earnings”.

Earnings quality and, more generally, financial reporting quality are of interest to those who use financial reports for contracting purpose and for investments decision making (Schipper and Vincent, 2003).

Some of the most important definitions, constructs and measures are related with the persistence, predictability and variability of earnings (time-series properties of earnings). Persistence has to be understood in the sense that current earnings provide a good indication of future earnings, capturing the extent to which a given innovation remains in future realizations. Predictability is a function of the distribution (especially the variance) of the innovation series: “the ability of past earnings to predict future earnings” (Lipe, 1990). Variability measures the time-series variance of innovations directly (Leuz *et al.*, 2003). Hermanns (2006) considers an additional measure derived from time-series properties of earnings - informativeness of earnings: the capacity to explain stock returns (Warfield *et al.*, 1995) or the information content with respect to future earnings (Ahmed *et al.*, 2004).

Others relate earnings quality to the relation between income, accruals and cash, taking the view that earnings that map more closely into cash are more desirable (*e.g.*, Penman, 2001). According to several authors (*e.g.*, Sloan, 1996; Graham *et al.*, 2005; Richardson *et al.*, 2005 and 2006), we can assess earnings quality considering the relation between accruals and cash flows. In line with this point of view, the results of Graham *et al.* (2005) indicate that financial officers believe that earnings, not cash flows, are the key metric to outsiders. Managers are focused on short-term earnings benchmarks, especially the seasonally lagged quarterly earnings number and the analyst consensus estimate. Managers also work to maintain predictability in earnings and financial disclosures. This finding could reflect superior informational content in earnings over the other metrics.

In fact, several studies document the benefits of the accruals process, finding that earnings is a better measure of performance than the underlying cash flows (*e.g.*, Dechow and Schrand, 1994; Dechow *et al.,* 1998; Dechow and Dichev, 2002), that earnings explain more of the cross-sectional variation in stock returns or stock prices relative to operating cash flows (*e.g.*, Bernard and Stober, 1989; Dechow, 1994; Barth *et al.*, 2001; Liu *et al.*, 2002). Being the accruals accounting more ambitious than a "cash-flow-oriented accounting system" (Beaver and Demski, 1979: 43). Dechow (1994) finds that accruals improve earnings' ability to measure performance relative to cash flows.

Sloan (1996) finds that the accruals portion of earnings is less persistent than the cash flow portion. This suggests that firms with high levels of accruals have low quality of earnings. Dechow and Dichev (2002), analysing the interrelations between accrual quality, level of accruals, and earnings persistence suggests a reconciliation of the findings of Dechow (1994) and Sloan (1996). Their reconciliation is based on the observation that a high level of accruals signifies both earnings that are a greater improvement over underlying cash flows, and low-quality earnings.

This emphasis on earnings, indicating that earnings have more information content about firm value than to cash flow is noteworthy because cash flows continue to be the measure emphasized in the finance literature.

In the path of Sloan (1996), academic researchers focused on the development of simple empirical models that objectively assess earnings quality in order to predict future return performance, (see, for example, Penman and Zang, 2002; Richardson *et al.*, 2005 and 2006; Chan *et al.*, 2006). For Richardson *et al.* (2005 and 2006) earnings quality is the degree to which earnings performance persists into the next period.

Another earnings quality dimension is derived from qualitative concepts in the IASB/FASB's conceptual framework. The conceptual framework focuses on decision usefulness, defined in terms of relevance and faithfully representation, as the criterion for assessing quality. And some authors, namely Schipper and Vicent (2003) and Hermans (2006), consider another earnings quality category, which is derived from implementation decisions. Earnings quality is seen as the accurate representation of underlying economic transactions and events as in Penman and Zhang (2002).

Schipper and Vicent (2003: 98) view earnings quality in relation to Hicksian income[10], more precisely, they see it as the extent to which reported earnings faithfully represent Hicksian income. The term "faithfully representing" means the "correspondence or agreement between a measure or description and the phenomenon that it purports to represent".

Dechow *et al.* (2010: 344) consider that earnings quality is "conditional on the decision-relevance of the information", so, in this sense the authors consider that the term "earnings quality" alone is meaningless, earnings quality is defined only in the context of a specific decision model. The quality of earnings could be evaluated with respect to *any* decision that depends on an informative representation of financial performance and it depends on many aspects which are unobservable.

In the table 1.1 we summarize some main earnings quality definitions found in literature:

[10] Hicksian income (Hicks, 1939) corresponds to the amount that can be consumed (that is, paid out as dividends) during a period, while leaving the firm equally well off at the beginning and the end of the period, that is, the maximum amount that can be consumed consistent with the maintenance of wealth.

Table 1.1 – Definitions on earnings quality

Author	Definition
Bernstein and Siegel (1979: 73)	"Earnings figures should have integrity – that is, they should not be the product of manipulations designed purely to increase the reported income of the company. Earnings figures should also be reliable, in the sense that they provide a good indication of the firm's earning power. But it is important to keep in mind that the notion of 'quality', in the context of earnings evaluation, is one of *comparative*, integrity, reliability and predictability. There are no absolute elements of earnings quality".
Bernstein (1996: 749)	"Virtually there is no general agreement as regard to the definitions or assumptions on this term (earnings quality)".
Penman and Zhang (2002: 237)	"(...) earnings can be regarded as good quality if it is a good indicator of future earnings".
Schipper and Vicent (2003: 98)	"We define earnings quality as the extent to which reported earnings faithfully represent Hicksian income, where representational faithfulness means correspondence or agreement between a measure or description and the phenomenon that it purports to represent".
Dechow and Schrand (2004: Preface)	"A high-quality earnings number, as we define it, will do three things: it will reflect current operating performance; it will be a good indicator of future operating performance; and it will accurately annuitize the intrinsic value of the firm. Not all earnings are created equal. Earnings quality depends on the composition of the earnings, the stage of the company's life cycle, the time period, and the industry."
Ghosh *et al.* (2005: 33)	"With respect to earnings quality, firms with revenue-supported increases in earnings have more persistent earnings, exhibit less susceptibility to earnings management, and have higher future operating performance."
Dechow *et al.* (2010: 344)	"Higher quality earnings provide more information about the features of a firm's financial performance that is relevant to a specific decision made by a specific decision-maker".

For us, and according to Dechow and Schrand (2004), the quality of earnings is a summary metric in performance evaluation and a focal question to assess the quality of accounting information. A high-quality earnings number will reflect current operating performance, being a good indicator of future operating performance, and it accurately annuitizes the intrinsic value of the firm.

In order to explore the earnings quality concept and its implications for firm value, we present in the next section the relevant literature on studies about the relationship between financial statement data and firm value based on valuation models (*e.g.*, Ohlson, 1995; Feltham and Ohlson, 1995; Ohlson, 1999).

1.3. The relationship between financial statement data and firm value

The quality of accounting information is a function of its relevance, which means of its predictive, informativeness and confirmatory value. Information has predictive value if it has value as an input to predictive processes used by investors to form their own expectations about the future.

The accounting model communicates an asset based view of organizational reality, which is consistent with the assertion that the "primary focus of financial reporting is information about a company's performance provided by measures of comprehensive income and its components. Earnings and its components measured by accrual accounting generally provide a better indication of enterprise performance than information about current cash receipts and payments" (FASB, 1978 § 43). The FASB position finds support in the empirical evidence which documents that earnings constitute a more relevant proxy of the future cash flows comparatively to the contemporaneous values of cash flows (Barth *et al.*, 2001; Dechow *et al.*, 1998). It is also important to add that in the medium and long term, firm earnings and cash flows tend to be synchronic.

The financial and economic models establish relationships between earnings or cash-flows of the companies and their market value (for example, Fama and Miller, 1972: Chapter 2). The earnings role, as well as the one of other financial variables, in many of these models consists of supplying investors with information on stock returns (for example, Ohlson, 1988). In that context, the quality of the company performance is assessed by its contribution to predict future stock returns.

Earnings are important for evaluation effects, or in other words, the investors see in earnings a valuable information source to assess the firm value, and, in this sense, earnings quality concept is a way to assess the relevance, the reliability of earnings, in short, the informativeness of earnings, in terms of value relevance.

The link between accounting values and contemporaneous equity values have been extensively studied. Valuation models based on earnings, and based on book value, are viewed typically as an alternative approach to assess the firm value (Barth and Landsman, 1995). When market assumptions are more realistic and markets are imperfect, book values and earnings act as complementary indicators of equity values (*e.g.*, Feltham and Ohlson, 1995; Ohlson, 1995; Penman, 1998). Ohlson's (1995) model, which offers a formal link between valuation and accounting numbers, is cited frequently as the theoretical foundation of such research. In fact, the Ohlson (1995) paper became a classic (Lo and Lys, 2001), being the paper most cited in the last decades, into this research area[11].

Let us now move backwards in time and in terms of relevant literature to look for studies about the relationship between financial statement data and firm value (section 1.3.1.). And in chapter 2, we describe our proposed empirical model, which reinterprets rebuilding the linear information model (LIM) in relation to the market value added and captures, in a composite measure, the three earnings quality constructs: persistence, predictability and informativeness of earnings.

1.3.1. The Feltham-Ohlson framework: implications for empirical research

The Ohlson (1995) and Feltham and Ohlson (1995) studies stand among the most important developments in capital markets research in the last several years (Beaver, 2002)[12]. These studies provide a foundation for redefining the appropriate objective of research on the relation between financial statement data and firm value. At the same time, they provide some structure for modelling in a field where structure has been sorely lacking.

The Ohlson model (Ohlson, 1995) derives of the Residual Income Valuation Model (hereafter RIV) or Edwards-Bell Model (hereafter EB) (Edwards and Bell, 1961). Those models are already thoroughly recognized in the literature. It is important to highlight that the initial theoretical framework is the neoclassical model of the present value of

[11] Brown (1996) characterizes the papers cited in the SCCI – *Social Sciences Citation Index*, as been a classic, the mean quotation of the same is situated, at least between 4.00 and 8.35. According to Lo and Lys (2001), in 1999, and with reference to the Ohlson model (1995), the citations mean was already superior to 9.

[12] Beaver (2002: 457): "The F-O approach [Ohlson, 1995 and Feltham and Ohlson, 1995] is, in my opinion, one of the most important research developments in the last ten years".

future expected dividends (hereafter PVED) developed by Williams (1938), and well-known for the Gordon Model[13] which assumes an economy where the agents beliefs are homogeneous and individuals are risk-neutral. Note that RIV is a specific case of PVED model.

The Ohlson (1995) and Feltham and Ohlson (1995) studies provide a logically consistent framework for thinking about the value relevance of accounting numbers. They show how:

- To link the market value of equity (MVE_t) with the past and future financial information of the firm, that is: i) with the contemporaneous and future net income; ii) with the book value and how to use book value and income together in the same valuation model; and iii) with dividends;
- The valuation model can be used to capture different properties of different asset classes, such as operating and financial assets, and different value relevance of earnings components;
- To illustrate the effect of conservative accounting on the relation between equity value, accounting book value, and future earnings.

Feltham and Ohlson (1995: 726) said that "one can view abnormal earnings as a contraction of "above normal earnings", where normal earnings equal the risk-free interest rate times the book value of firm's equity". In the following table, table 1.2, we present some definitions about "abnormal earnings"; however the management accounting literature typically refers to it as "residual income".

[13] Gordon and Shapiro (1956) rewrite the initial model, admitting the assumption that the growth rate for the dividends is constant.

Table 1.2 – Definitions on abnormal earnings

Author	Definition
Canning (1929) and Preinreich (1938)[14]	These authors refer to "abnormal earnings" as "excess earnings".
Edey (1957)[15]	Refers to abnormal earnings or abnormal profits as "super-profits".
Edwards and Bell[16](1961)	Refers to abnormal earnings as "excess realizable profit".
Peasnell (1981, 1982)[17]	Refers to abnormal earnings as "excess income".
Ohlson (1995: 663)	"(...) this variable (abnormal earnings) is defined as current earnings minus the risk-free rate times the beginning of period book value, that is, earnings minus a charge for the use of capital".
Feltham and Ohlson (1995: 691)	"(...) abnormal earnings are defined to equal reported earnings minus the risk-free interest rate times the book value of the firm's equity".
Myres (1999: 2)	Throughout the paper, he uses the term "residual income" (RI) rather than the standard "abnormal earnings" because readers tend to relate abnormal earnings with abnormal stock market returns or unexpected earnings. Residual income (RI) may be completely anticipated. In fact, RI valuation depends on the anticipation of future RI.
Riley *et al.* (2003: 232); Barth *et al.* (2005)	Abnormal earnings are based on the definition provided in Ohlson (1995).

Given the competition effect, it is expected that the abnormal earnings follow a mean reverting process, that is, it is expected that abnormal earnings quickly revert for the sector/industry mean. Thus under unbiased accounting, in the medium and long period the book value of the common equity (BVE_t) constitutes an unbiased estimator of the firm market value of equity (MVE_t).

Knowing that Feltham-Ohlson (1995) framework came through the Ohlson (1995) model, adding some complexity, we will begin by presenting the Ohlson (1995) model (assumptions and definitions based on residual income valuation model) in next sub-section A, the linear information dynamics and the "other information" will be presented in sub-section B, then we will present the linear information dynamics extensions based on Feltham and Ohlson (1995) in sub-section C.

[14] *Apud* in Feltham and Ohlson (1995: 726).
[15] *Apud* in Feltham and Ohlson (1995: 728).
[16] *Apud* in Feltham and Ohlson (1995: 728).
[17] *Apud* in Canadas (2004: 214).

A) The Ohlson (1995) model

The analytical model of Ohlson (1995) proposes an approach consistent with a measurement perspective, revealing that the fundamental value of a company can be expressed by the fundamental components of balance sheet and profit and loss account. Ohlson (1995) does not explicitly consider the uncertainty, assuming neutral position towards the risk, the absence of information asymmetry, non stochastic interest rates and a term structure of horizontal interest rates, the cost of capital being given by the risk free interest rate. In other words, connected to the Ohlson framework is the concept of an ideal market functioning, which does not accept the existence of information asymmetry between companies and investors, and of a set of assumptions that secure the consistency with the basic principles of the financial theory.

There are three crucial assumptions in the Ohlson model. They are based on Residual Income Valuation Model (RIV). Table 1.3 introduced them:

Table 1.3 – The residual income valuation model development: assumptions

Crucial assumptions	Analytic formulation
Assumption A₁ is the **equilibrium condition**: the market value of the firm in time t (MVE_t) is equal to the present value of expected dividends. By reference to Ohlson (1995), it actually follows a more primitive assumption about the economy. In particular, assumption ***A₁*** is the no intertemporal arbitrage price that results when: – Interests rates are nonstochastic; – Beliefs are homogeneous; – Individuals are risk-neutral. Ohlson formulation requires a valuation assumption based on the present value of expected future dividends, on the irrelevancy of dividends politics for the determination of the firm value (Modigliani and Miller, 1958 and 1961).	[1.1] $MVE_t = \sum_{\tau=1}^{\infty} \frac{E_t\left[\tilde{d}_{t+\tau}\right]}{\left(1+r_f\right)^{\tau}}$ Where: MVE_t - price of the firm's equity at time t; d_t - net dividends paid at time t; R_f - risk-free return, $R_f = 1 + r_f$ · r_f is a risk-free discount rate, which is an intertemporal constant rate; $E_t[...]$ - expected value operator conditioned on date t information.
Assumption A₂ defines the clean-surplus relation as: book value this	

Table 1.3 – The residual income valuation model development: assumptions

Crucial assumptions	Analytic formulation
year equals last year's book value plus income minus dividends (and, therefore, a capital contribution corresponds to a negative dividend). This assumption allows future dividends to be expressed in terms of future earnings and book values.	[1.2] $BVE_t = BVE_{t-1} + x_t - d_t$ Denote that: BVE_t - book value of equity at time t; x_t - earnings for the period from $t-1$ to t; d_t - net dividends paid at time t;
With these two assumptions (**A₁** and **A₂**) and with simple algebraic manipulation, Ohlson derives the following relation between price and accounting information.	[1.3] $MVE_t = BVE_t + \sum_{\tau=1}^{\infty} \frac{E_t\left[x_{t+\tau} - r_f BVE_{t+\tau-1}\right]}{\left(1+r_f\right)^{\tau}} - \frac{E_t\left[BVE_{t+\infty}\right]}{\left(1+r_f\right)^{\infty}}$
The "residual income" or "abnormal earnings" is defined as the amount the firm earns in excess of the risk-free rate of interest on the book value.	[1.4] $x^a_{t+\tau} \equiv x_{t+\tau} - r \times BVE_{t+\tau-1}$
With this definition the valuation expression can be written even more succinctly as the sum of book value and the present value of future abnormal earnings: Equation [1.5] presents the company's fundamental value defined in terms of accounting variables.	[1.5] $MVE_t = BVE_t + \sum_{\tau=1}^{\infty} \frac{E_t\left[x^a_{t+\tau}\right]}{\left(1+r_f\right)^{\tau}}$
Assumption A₃ is a final assumption in Ohlson's paper referred as the "linear information model". This third assumption provides the additional structure necessary to yield dividends irrelevancy. It defines the stochastic process for abnormal earnings and non accounting information **(**v_t**)** as:	[1.6] $x^a_{t+1} = \omega x^a_t + v_t + \varepsilon_{1t+1}$ $v_{t+1} = \gamma v_t + \varepsilon_{2t+1}$ Where ω and γ are fixed and known parameters between zero and one, and εs are mean zero and uncorrelated with other variables in the model[18]. Assumption ***A₃*** says that both abnormal earnings and non accounting information are autoregressive. In *latu sense*, these exogenous parameters to the model are determined by the environmental context that characterizes the firm.

[18] ω and γ parameters assume values bigger than zero, due to economical conditions and values inferior to the unit in order to guarantee the model's stability/stationarity. This condition implies that $E_t\left(x^a_{t+\tau}\right) \to 0$ and $E_t\left(v_{t+\tau}\right) \to 0$ with $\tau \to \infty$. If indeed $\omega = 1$, this means that the growing opportunities persisted indefinitely, which is not consistent with the empirical evidence.

Analyzing the mathematical expressions [1.1], [1.3] and [1.5], we found that Ohlson framework is a direct descendant of the research done in the 1960s (*e.g.*, Edwards and Bell, 1961; Modigliani and Miller, 1958 and 1961) and also Preinreich (1938). In fact, the valuation expression of accounting data writing succinctly as the sum of book value and the present value of future abnormal earnings is not new, it can be found in Preinreich (1938), and Edwards and Bell (1961). Its revival constitutes a major contribution to modern financial accounting. By using earnings, book value, and the clean surplus equation to carry the dividend information, we can rewrite the discounted dividend valuation as a discounting of accounting numbers.

In mathematical expression [1.5]:

$$MVE_t = BVE_t + \sum_{\tau=1}^{\infty} \frac{E_t\left[x_{t+\tau}^a\right]}{\left(1+r_f\right)^{\tau}}$$

"A firm's value equals its book value adjusted for the present value of anticipated abnormal earnings" (Ohlson, 1995: 667). This value is a function of book value of equity, with unit coefficient, and infinite geometric series of expected abnormal earnings, "unrecorded goodwill" in the authors' terminology, or the "market valued added", for the proposers of EVA™ terminology. The goodwill equals the current value of the expected abnormal earnings and the firm's value or the firm's evaluation can be centered on the prediction of these. In other words, behind this formula there is a connection that can be summarized in the following way:

$$MVE_t = BVE_t + g\omega_t$$

Considering $g\omega_t$ the value of the company's goodwill, in other words, the intangible assets value not expressed on the balance sheet, measured from the abnormal earnings that the company will generate in the future. The value of the company's goodwill ($g\omega_t$) becomes the component that corrects the asset value (BVE_t) in order to obtain the company's fundamental value.

The transformation of the expression [1.5] in others that includes only contemporaneous accounting information requires the definition of a evolution process of the future abnormal earnings (x_t^a), this is the third assumption considered in the previous table, table 1.3, **Assumption A$_3$**.

B) Linear information model (LIM) and *other information*

Ohlson assumes that the abnormal earnings of the period $t+1$ $\left(x_{t+1}^a\right)$ are dependent of the earnings observed in the previous period $\left(x_t^a\right)$ and of the *other information* $\left(v_t\right)$ that may affect the prediction of x_{t+1}^a and is not reflected in x_t^a. The relationship between these components completes the following stochastic process.

$$\begin{aligned} x_{t+1}^a &= \omega\, x_t^a + v_t + \varepsilon_{1t+1} \\ v_{t+1} &= \gamma v_t + \varepsilon_{2t+1} \end{aligned} \qquad [1.6]$$

This **assumption A$_3$** is a final assumption in Ohlson's model referred as the "linear information dynamic". This third assumption provides the additional structure necessary to yield dividends irrelevancy.

The parameters ω and γ are fixed and known, they assume values between zero and one, and ε's are mean zero variables and uncorrelated with other variables in the model. These parameters are exogenous to the model and are determined by the environmental context that characterizes the firm.[19] The only restriction to which they are subjected is that they are inferior to the unit, which means that the process will converge to zero. The prediction of the *other information* (v_{t+1}) is not a function of the earnings, considering that it synthesizes the information not yet reflected in the financial statements.

[19] As referred by Mota *et al.* (2004), the value of a company depends of multiple factors that involve the detailed analysis of a set of variables associated to the company (market position, profitability, financial structure, management characteristics, human resources quality, etc.), as well as an analysis of the environment in which the company operates (macro-economical, political, activity sector, competition variables, among others.)

The Ohlson (1995) innovation in relation to the Residual Income Valuation Model (RIV) or Edwards-Bell Model consists in the treatment that he gives to the structure of the abnormal earnings time-series (x_t^a). In order to define the stochastic process that follows the x_t^a variable, Ohlson (1995) introduces the v_t variable - *other information*: a variable that captures important events in terms of informative content and that affect the market prices (market value of equity – MVE_t), but that are not yet reflected in the financial statements. This means that *other information* variable captures the extent to which the accounting variables do not explain market value of equity. This is a time *lag* that mediates the occurrence of certain events that are important for the formulation of economic agents expectations, and its inclusion in the financial statements, it conveys information for the beliefs formulation on the firm abnormal earnings growth. *Other information* is one of the limitations pointed out in the financial statements, or better to its capacity in disclosing all the important information and in opportune time – *lack of timeliness* (Rayn, 1995; Beaver, 2002). In line with Lundholm (1995: 752) nonaccounting information (or *other information*) is an additive shock to next period's abnormal earnings. In order to correct this *gap*, Ohlson (1995) used the dynamics of information to characterize the abnormal earnings dynamics: a first-order autoregressive process (AR(1)).

In the table 1.4 we present the main definitions of *other information*:

Table 1.4 – Definitions on *other information*

Author	**Definition**
Ohlson (1995: 668)	"(...) *other information* (v_t) as capturing all nonaccounting information used in the prediction of future abnormal earnings".
Feltham and Ohlson (1995: 702 and 703)	"(...) nonaccounting data, provide the basis for predicting future abnormal operating earnings". "(...) The *other information* acts as serially correlated, but convergent, noise in the prediction of abnormal earnings and operating assets".
Lundholm (1995: 752)	"(...) nonaccounting information is an additive shock to next period's abnormal earnings".
Barth *et al.* (2005: 315)	"(...) *other information*, v_t , is defined as $MVE_{t-1} - \overline{MVE_{t-1}}$, where $\overline{MVE_{t-1}}$

Table 1.4 – Definitions on *other information*

Author	**Definition**
	is the fitted value of MVE_{t-1} on the equation: $MVE_{it} = \alpha_0 + \alpha_1 NI_{it}^a + \alpha_2 BV_{it} + \alpha_3 v_{it} + \mu_{it}$ that does not include v_t. MVE is market value of equity, NI^a is abnormal earnings, defined as earnings minus the normal return on equity book value, BVE, μ_{it} is the error term and i and t subscripts denote firm and year".

Kothari (2001) notes that the current performance of a firm (as represented in accounting reports) is an important information source but not the only for assessing the firm market value. Dechow *et al.* (1999) point out that academic literature recognizes that stock prices reflect information about future earnings that are not contained in current earnings. Such information "can not be observed directly" (Ohlson, 2001: 112). In operational terms, candidates for these *other information* (v_t) are new patent, laws to approve a new product in pharmaceutical firms, long-term contracts, among others (Myres, 1999).

Ohlson (1995) defines *other information* as a scalar variable, but not specifically establishes its analytical content. Ohlson (2001: 112) referred to v_t as a "mysterious variable". The fuzzy and abstract character of this idea, *other information*, has led that some empirical applications, based on Ohlson model, use this variable in an *ad hoc* form or simply neglect it. Hand (2001) notes that, until 1998, almost all empirical research on Ohlson model neglected the information content of this variable (*other information*). The few papers that not neglected the *other information* variable chose an intuitive way rather than a formal construction [*e.g.*, Amir and Lev (1996); Myres (1999); Barth *et al.* (2005)].

Ohlson (2001) states that, although there may be an analytical interest in not specify the value of v_t, such procedure reduces the empirical content of the Ohlson model. It is highlighted that, for example, the financial analysts' predictions constitute a reasonable tool to measure the expected future profits and that there is no reason to eliminate v_t of the model since the variable can be supported in observable data. Hand (2001) adds that to consider v_t equal to zero is to assume that the accounting data publicly available are sufficient to explain the behaviour of the stock prices.

To sum up, in the next table 1.5, some important aspects are highlighted in order to correctly understand the model, and finally, the intrinsic value of the company is also presented as well as the linear solution of the model's coefficients.

Table 1.5 – Linear information model and *other information*

1) Linear information model (LIM):	[1.6] $x^a_{t+1} = \omega\, x^a_t + v_t + \varepsilon_{1t+1}$ $v_{t+1} = \gamma v_t + \varepsilon_{2t+1}$
2) *Other information* (v_t) :	– The *other information* is incorporated in the residual income with a discrepancy, having a gradual impact on the earnings, in other words, v_t follows a first order auto-regressive process; – Ohlson (1995) defines v_t as a scalar variable, independent from x^a_t, which should be considered as summarizing the relevant events in terms of value which did not yet have an impact on the financial statements;
3) Random terms $(\varepsilon_{1t+1}\,;\,\varepsilon_{2t+1})$:	All the components of the model introduced are known. The only sources of uncertainty are the random terms $(\varepsilon_{1t+1}\,;\,\varepsilon_{2t+1})$, which can be associated to new information (not expected) which is translated into equally in unexpected earnings.
4) Parameters $(\omega\,;\,\gamma)$:	– They are determined by the entity's economical environment and by the accounting principles; – They are positive and less than one, $0 \le \omega < 1$ and $0 \le \gamma < 1$. The model introduces in the theory the concept of earnings persistence, represented by the parameter ω. The persistence reflects the degree in which the current abnormal earnings are reproduced on the next period: - If $\omega = 0$ there is no earnings persistence. On each period these would be only function of the other information and of the new information (unexpected). The events that affect the current earnings are transitory; - If $\omega = 1$, current earnings would be fully reproduced on the next period, which means that the growth opportunities persisted indefinitely, this is not consistent with the empirical evidence. - If $0 \le \omega < 1$, as predicted in the model, the earnings

Table 1.5 – Linear information model and *other information*

	persistence is not total and current events that affect the current earnings tend to have a decreasing impact on future earnings.
5) The linear solution – the intrinsic value:	The combination of the earnings' dynamic [1.6] with the model introduced in [1.5] allows to obtain a model in which the intrinsic value depends only on the contemporaneous accounting information: [1.7] $MVE_t = BVE_t + \alpha_1 x_t^a + \alpha_2 v_t$ Being: $\alpha_1 = \dfrac{\omega}{1+r_f-\omega} \geq 0$ and $\alpha_2 = \dfrac{1+r_f}{(1+r_f-\omega)(1+r_f-\gamma)} > 0$

So, the current intrinsic value of the company, defined by the expression [1.7], can be attained based on the current values of the book value equity, the abnormal earnings and the *other information*, considering the above specification of the linear information dynamic (expression [1.6]). The impact on the company's value of these variables will depend on the persistence of earnings and on the discount rate of future profitability flows[20].

"Larger values of ω and γ make MVE_t more sensitive to $\left(x_t^a, v_t\right)$realizations" (Ohlson, 1995: 669). However, the bigger the "persistence parameters" are, ω and γ, the faster the decline process will be. Anyway, these two parameters are enough in this context to characterize the earnings persistence. "The function $\alpha_1(\omega)$ and $\alpha_2(\omega,\gamma)$ are increasing in their arguments. The property reflects that ω and γ act as persistence parameters in the $\left(x_t^a, v_t\right)$ process" (Ohlson, 1995: 669).

[20] It is important to highlight that the company's value does not depend on the dividend policy, consistent with the assumption adopted regarding its irrelevance.

C) Linear information model extensions based on Feltham and Ohlson (1995)

Feltham and Ohlson (1995) extend the Ohlson model (Ohlson, 1995) introducing two new effects: "conservatism accounting effect" and the "growth in the operating assets".

The "conservatism accounting effect" reflects the persistence of the difference between the market value of equity (MVE_t) and book value of common equity (BVE_t), which originates the "unrecorded goodwill", in the authors' terminology or the "market valued added". This "unrecorded goodwill" can result of an undervaluation of assets and/or of an overestimate expected abnormal earnings.

Taking into consideration that "conservatism accounting effect" results in goodwill, Feltham and Ohlson (1995) admit that the current accounting value offers information about future abnormal earnings and they introduce the distinction between the value of operating assets (oa_t) and financial assets (fa_t). In this way, in order to consider the abnormal earnings persistence effect, the conservatism accounting effect, as well as the growth in both operating assets (oa_t) and operating earnings (ox_t), Feltham and Ohlson (1995) redefine the information dynamic initially specified on the Ohlson model (1995). Thus, the linear information model (LIM) is now defined as (see table 1.6):

Table 1.6 – Linear information model extensions (Fetham and Ohlson, 1995)

Linear information model extensions by (Feltham and Ohlson, 1995):	[1.8] $\begin{cases} ox^a_{t+1} = \omega_{11} ox^a_t + \omega_{12} oa_t + v_{1t} + \varepsilon_{1,t+1} \\ oa_{t+1} = \quad + \omega_{22} oa_t + v_{2t} + \varepsilon_{2,t+1} \\ v_{1,t+1} = \quad \gamma_1 v_{1t} + \varepsilon_{3,t+1} \\ v_{2,t+1} = \quad \gamma_2 v_{2t} + \varepsilon_{4,t+1} \end{cases}$ Where: $ox^a_t \left(= x_{t+1} - r_f * oa_{t+1}\right)$ - operating abnormal earnings after taxes at time t; r_f is a discount rate, which is an intertemporal constant rate; oa_t - operating assets at time t; v_{1t}; v_{2t} - *other information*; $\varepsilon_{1t+1}; \varepsilon_{2t+1}; \varepsilon_{3t+1}; \varepsilon_{4t+1}$ - random terms. With: $0 \le \omega_{11} < 1, \quad 0 \le \gamma_k < 1\,(k = 1;2), \quad \omega_{12} \ge 0$ and $1 \le \omega_{22} < (1 + r_f)$.

Table 1.6 – Linear information model extensions (Fetham and Ohlson, 1995)

ω_{12} coefficient:	The parameter ω_{12} allows us to introduce the dichotomy in the analysis "unbiased accounting" versus "conservative accounting", that is, the problem of the operating assets understatement (the problematic of subvaluation of the operating assets). – If $\omega_{12} > 0$, there is conservatism in accounting (undervaluation of the operating assets). More conservatism indicates that bigger abnormal earnings are expected.
ω_{22} coefficient:	The parameter ω_{22} reflects the operating assets growth effect, it assumes values belonging to the interval $\left[1, R_f\right[$, with $R_f = (1+r_f)$. R_f is the risk-free return and r_f is a discount rate, which is an intertemporal constant rate. This way, restrictions to the operating assets long term growth are introduced to ensure the convergence on the calculus of the abnormal operating earnings present value (ox_t^a).
The linear solution – the intrinsic value:	Considering: $BVE_t = oa_t + fa_t$ Note that: bv_t - book value of equity at time t; oa_t - operating assets at time t; fa_t - financial assets at time t; [1.9] $MVE_t = BVE_t + \alpha_1 ox_t^a + \alpha_2 oa_t + \beta_1 v_{1,t} + \beta_2 v_{2,t}$ With: $\alpha_1 = \frac{\omega_{11}}{1+r_f-\omega_{11}} \geq 0$, $\alpha_2 = \frac{\omega_{12}(1+r_f)}{\left(1+r_f-\omega_{11}\right)\left(1+r_f-\omega_{22}\right)} \geq 0$ And, $\beta_1 = \frac{1+r_f}{(1+r_f-\omega_{11})\,(1+r_f-\gamma_1)} > 0$, $\beta_2 = \frac{\alpha_2}{1+r_f-\gamma_2} \geq 0$

In this context, and based on the mathematical expression [1.9], the goodwill ($g\omega_t$) is identified as:

$$[1.10] \qquad MVE_t - BVE_t = g\omega_t = \alpha_1 ox_t^a + \alpha_2 oa_t + \beta \bullet v_t$$

This is, the goodwill is a growing function of the abnormal operating earnings, whose persistence is measured by parameter ω_{11} (the higher ω_{11} is, the greater α_1 will be), of the operating assets (oa_t) only if these are under evaluated due to the fact that the necessary condition to $\alpha_2 > 0$ is that $\omega_{12} > 0$ and of the variable v_t. Note also that in both models (the Ohlson model and the Feltham and Ohlson model) the tax effect is ignored.

However, and since both models assume a perfect capital market (for which costs derived from information asymmetry, agency and transaction are not equally admitted), the Feltham and Ohlson model also assumes that financing decisions do not create value. The tax effect will not have relevant consequences on the evaluation function.

Earnings persistence or the earnings quality is not just a function of the “conservatism accounting effect”, but also a function of the different value relevance of the different earnings components.

The different value relevance of the different earnings components leads Ohlson (1999) to extend Ohlson (1995) by modeling the earnings components. In this way, the Ohlson (1999) model incorporates a x_2 variable, defined as transitory earnings, which can be any earnings components (cash flows or accruals), that evidences an incremental explanatory power on the prediction of future abnormal earnings.

In the next sections 1.3.2 and 1.3.3, a very brief presentation of the Ohlson model (1999) is presented together with the generalized version used by Barth *et al.* (1999 and 2005), respectively.

1.3.2. The different value relevance of the different earnings components

Ohlson (1999) considers concepts of "transitory earnings", and analyses how this source of earnings differs from other income items.

The Ohlson (1999) modelling follows Ohlson (1995), but with an extension to permit two earnings' components: "core" earnings (x_{1t}) and "transitory" earnings (x_{2t}). In the next table, table 1.7., we present the Ohlson (1999) model, its assumptions and definitions:

Table 1.7 – Ohlson (1999) model: assumptions and definitions

Crucial assumptions	**Analytic formulation**
The equation [1.1] and [1.2] correspond to the first two assumptions of the Ohlson (1999) model which are standard of the residual income model and which are used in the Ohlson (1995) model, explained previously in table 1.3. According to Ohlson (1999: 148), "in words, the present value of expected dividends determines value, and regular owners' equity accounting applies. One can think of x_t as including any dirty surplus items which have bypassed the "official" income statement. Alternatively, one can think of equation [1.2] as a definition rather than as an assumption". Equations [1.1] and [1.2] imply the well-known residual earnings valuation formula: equation [1.5].	[1.1] $MVE_t = \sum_{\tau=1}^{\infty} \frac{E_t\left[\tilde{d}_{t+\tau}\right]}{\left(1+r_f\right)^{\tau}}$ [1.2] $BVE_t = BVE_{t-1} + x_t - d_t$ Where: MVE_t - price of the firm's equity at time t; d_t - net dividends paid at time t; R_f - risk-free return, $R_f = 1 + r_f \cdot r_f$ is a discount rate, which is an intertemporal constant rate; $E_t[...]$ - expected value operator conditioned on date t information. BVE_t - book value of equity at time t; x_t - earnings for the period from $t-1$ to t; [1.5] $MVE_t = BVE_t + \sum_{\tau=1}^{\infty} \frac{E_t\left[x^a_{t+\tau}\right]}{\left(1+r_f\right)^{\tau}}$
Equation [1.11] is the critical assumption introduced by Ohlson (1999). It specifies the forecasting of the sequence of expected abnormal earnings in terms of the current information. Some important comments: – It may seem inevitable that ω_{22} should be zero if one wants to label x_{2t} transitory earnings. $\omega_{22} = 0$ means transitory earnings unpredictability, this is, an attribute of transitory earnings. – If $0 < \omega_{22} < 1$ is interesting because it leads to	[1.11] $x^a_{t+1} = \omega_{11} x^a_t + \omega_{12} x_{2t} + \varepsilon_{1t+1}$ $x_{2t+1} = \omega_{22} x_{2t} + \varepsilon_{2t+1}$ Where x_{2t} are transitory earnings.

Table 1.7 – Ohlson (1999) model: assumptions and definitions

Crucial assumptions	Analytic formulation
serially correlated transitory earnings whose long run average equals zero. – The second sub-equation of the main equation [1.11] excludes a term $\omega_{21} x_t^a$ which means that $\omega_{21} = 0$. Core earnings and book value do not influence the evolution of transitory earnings (Ohslon 1999: 148). This assumption may appear somewhat restrictive, but it is, in fact, merely an assumption of analytical convenience. – $\omega_{12} \neq 0$ is an essential model ingredient since the concurrent predictor variable x_t^a includes transitory earnings. The real issue concerns the condition $\omega_{11} + \omega_{12} = 0$, as an assumption or conclusion – the forecasting-irrelevance.	
To generalize equation [1.11], consider the dynamic equations:	[1.12] $\begin{cases} x_{t+1}^a = \omega_{11}\, x_t^a + \omega_{12} x_{2t} + \gamma_1 \cdot v_t + \varepsilon_{1t+1} \\ x_{2t+1} = \omega_{22} x_{2t} + \gamma_2 \cdot v_t + \varepsilon_{2t+1} \\ v_{t+1} = G \cdot v_t + \varepsilon_{3t+1} \end{cases}$ Where v_t is a vector of K random variables representing “other information”; γ_1 and γ_2 are two K-dimensional vectors of fixed constants, and G is a square matrix of size $K \times K$.
The linear solution – the intrinsic value:	Applying the dynamic equation [1.12] to the residual income valuation formula [1.5], one obtains: [1.13] $MVE_t = BVE_t + \alpha_1 x_t^a + \alpha_2 x_{2t} + \beta \cdot v_t$ Where β is a K-dimensional vector. It can be shown that the parameters γ_1, γ_2, G do not affect α_1 and α_2, they still are: $\alpha_1 = \dfrac{\omega_{11}}{1 + r_f - \omega_{11}} \geq 0$, $\alpha_2 = \dfrac{\omega_{12}(1 + r_f)}{\left(1 + r_f - \omega_{11}\right)\left(1 + r_f - \omega_{22}\right)} \geq 0$

Table 1.7 – Ohlson (1999) model: assumptions and definitions

Crucial assumptions	Analytic formulation
	The elements in the vector β depend generally on ω_{11}, ω_{12} and ω_{22} as well as γ_1, γ_2, G, but the related mathematical expressions are of no interest here. Thus one can think of $\beta \cdot v_t$ as “background” information that influences value without violating the idea that accounting data provide kernel information. Ohlson (1999: 156) “to be sure, this feature works only because the information dynamics has a triangular structure”.

Considering the linear solution introduced by Ohlson (1999):

$$[1.13] \qquad MVE_t = BVE_t + \alpha_1 x_t^a + \alpha_2 x_{2t} + \beta \cdot v_t$$

The value-irrelevance occurs if $\alpha_1 + \alpha_2 = 0$, this condition implies that core abnormal earnings alone, rather than a combination of core abnormal earnings and transitory earnings, determine goodwill.

1.3.3. Barth *et al.* (1999 and 2005) models

As we said before, in the next chapter 2, we present our proposed model, which is based on the generalized version of the Ohlson (1999) model, which extends the Ohlson and Feltham-Ohlson framework (Ohlson, 1995; Feltham and Ohlson, 1995) and our model allows modelling earnings components, just as in Barth *et al.* (1999 and 2005), in this sense, we present a very brief presentation of the Barth *et al.* (1999 and 2005) model.

In developing predictions of how the accruals and cash flows components of earnings relate to equity value, Barth *et al.* (1999) consider a generalized version of the Ohlson (1999) model. The basic structure of the Barth *et al.* (1999) model is analogous to the *other information* model of Ohlson (1995) and the linear information dynamic of Myres (1999). The model of Barth *et al.* (1999) comprises four equations:

$$[1.14]\quad \begin{cases} (1.14a) & x^a_{t+1} = \omega_{11}x^a_t + \omega_{12}x_{2t} + \omega_{13}BVE_t + \varepsilon_{1t+1} \\ (1.14b) & x_{2t+1} = \omega_{22}x_{2t} + \omega_{23}BVE_t + \varepsilon_{2t+1} \\ (1.14c) & BVE_{t+1} = + \omega_{33}BVE_t + \varepsilon_{3t+1} \\ (1.14d) & MVE_t = BVE_t + \alpha_1 x^a_t + \alpha_2 x_{2t} + \mu_t \end{cases}$$

Equation [1.14a] is the abnormal earnings prediction equation, where abnormal earnings, x^a_t, is defined in the usual way as earnings less a normal return on equity book value. Although x_2 in Ohlson (1999) is modelled as transitory earnings, the model applies to any component of earnings. In Barth *et al.* (1999), x_2 is either accruals or cash flows. If all earnings components have the same ability to forecast abnormal earnings, x_2 will equal zero, and thus knowing that component of earnings does not aid in forecasting abnormal earnings, as in Ohlson (1999), this assumption is considered the "forecasting-irrelevance".

Barth *et al.* (1999) conclude empirically that accruals are a less persistent component of the abnormal earnings in comparison with the cash flows. Sloan (1996) also documents that the high levels of accruals are associated with systematic reductions of future earnings.

Barth *et al.* (1999) also conclude that there is a significant variation in the importance of the abnormal earnings coefficients among industries. Anyway, these components being less persistent, or more transitory, are relevant in terms of value. However, they would not be so, as Ohlson (1999) demonstrates, if they would not be relevant in the future earnings prediction or if the "forecasting-irrelevance assumption" would not be predictable.

Equation [1.14b] describes the autocorrelation of each earnings component.

Equation [1.14a] and equation [1.14b] include equity book value (BVE). According to Feltham and Ohlson (1995 and 1996), "including equity book value allows for the effects of conservatism to manifest themselves and partially relaxes the assumption that the cost of capital associated with calculating abnormal earnings is a predetermined cross-sectional constant" (Barth *et al.*, 1999: 208).

In Barth *et al.* (1999 and 2005), equation [1.14c] permits to preserve the triangular information structure of the generalized version of Ohlson's (1999) model. In theory, this triangular structure ensures that parameters relating to equity book value have no effect on the valuation multiples on abnormal earnings and the earnings components in equation [1.14d].

And finally, equation [1.14d] is the valuation equation based on the information dynamics in equations [1.14a] through [1.14c].

Later, Barth *et al.* (2005) extended the previous model and they considered three levels of earnings disaggregation based on the Feltham-Ohlson framewok: aggregate earnings, cash flows and total accruals and cash flows and four major components of accruals. At each level of earnings disaggregation, Barth *et al.* (2005) called three linear information models (LIMs) respectively.

The first linear information model, LIM1, is based on Ohlson (1995), and comprises four equations:

$$[1.15] \quad \begin{cases} (1.15a) \quad NI_t^a = \omega_{10} + \omega_{11} NI_{t-1}^a + \omega_{12} BVE_{t-1} + \omega_{13} v_{t-1} + \varepsilon_{1t} \\ (1.15b) \quad BVE_t = \omega_{20} \qquad\quad + \omega_{22} BVE_{t-1} + \varepsilon_{2t} \\ (1.15c) \quad v_{it} = \omega_{30} + \omega_{33} v_{it-1} + \varepsilon_{3t} \\ (1.15d) \quad MVE_t = \alpha_0 + \alpha_1 NI_t^a + \alpha_2 BVE_t + \alpha_3 v_{it} + \mu_t \end{cases}$$

MVE is market value of equity; NI^a is abnormal earnings, defined as earnings minus the normal return on equity book value, BVE; the ε_k and μ are error terms.

Equation [1.15a], equation [1.15b] and equation [1.15c] are forecasting equations, and equation [1.15d] is the valuation equation implied by the linear information dynamics of the forecasting equations.

In relation to the previous model, Barth *et al.* (2005) also added the *other information* variable (v_{it}). For these authors, the *other information* (v_{it}) is defined as $MVE_{t-1} - \overline{MVE_{t-1}}$, where $\overline{MVE_{t-1}}$ is the fitted value of MVE_{t-1} (market value equity) based on a version of equation [1.15d] that does not include v_{it}.

The second linear information model, LIM2, is based on Bart *et al.* (1999). It relaxes the assumption that the total accruals, ACC, and cash flows components of earnings have the same model parameters. LIM2 comprises five equations:

$$
[1.16] \quad \begin{cases}
(1.16a) \quad NI_t^a = \omega_{10} + \omega_{11} NI_{t-1}^a + \omega_{12} ACC_{t-1} + \omega_{13} BVE_{t-1} + \omega_{14} v_{t-1} + \varepsilon_{1t} \\
(1.16b) \quad ACC_t = \omega_{20} + \omega_{22} ACC_{t-1} + \omega_{23} BVE_{t-1} + \varepsilon_{2t} \\
(1.16c) \quad BVE_t = \omega_{30} + \omega_{33} BVE_{t-1} + \varepsilon_{3t} \\
(1.16d) \quad v_{it} = \omega_{40} + \omega_{44} v_{it-1} + \varepsilon_{4t} \\
(1.16e) \quad MVE_t = \alpha_0 + \alpha_1 NI_t^a + \alpha_2 ACC_t + \alpha_3 BVE_t + \alpha_4 v_{it} + \mu_t
\end{cases}
$$

For LIM2, equations [1.16a] through [1.16d] are forecasting equations, and equation [1.16e] is the valuation equation implied by the linear information dynamics of the forecasting equations.

Finally, the third linear information model, LIM3, further relaxes the assumption relating to earnings components by permitting the model parameters for four major accrual components to differ from one another as well as from those for other components of earnings, including cash flow. LIM3 comprises eight equations:

$$
[1.17]\quad
\begin{cases}
(1.17a) & NI_t^a = \omega_{10} + \omega_{11} NI_{t-1}^a + \omega_{12}\Delta REC_{t-1} + \omega_{13}\Delta INV_{t-1} + \omega_{14}\Delta PAY_{t-1} + \\
& \quad + \omega_{15} DEP_{t-1} + \omega_{16} BVE_{t-1} + \omega_{17} v_{t-1} + \varepsilon_{1t} \\
(1.17b) & \Delta REC_t = \omega_{20} + \omega_{22}\Delta REC_{t-1} + \omega_{23}\Delta INV_{t-1} + \omega_{25} DEP_{t-1} + \omega_{26} BVE_{t-1} + \\
& \quad + \omega_{27} v_{t-1} + \varepsilon_{2t} \\
(1.17c) & \Delta INV_t = \omega_{30} + \omega_{32}\Delta REC_{t-1} + \omega_{33}\Delta INV_{t-1} + \omega_{34}\Delta PAY_{t-1} + \omega_{35} DEP_{t-1} + \\
& \quad + \omega_{36} BVE_{t-1} + \varepsilon_{3t} \\
(1.17d) & \Delta PAY_t = \omega_{40} + \omega_{43}\Delta INV_{t-1} + \omega_{44}\Delta PAY_{t-1} + \omega_{46} BVE_{t-1} + \varepsilon_{4t} \\
(1.17e) & DEP_t = \omega_{50} + \omega_{55} DEP_{t-1} + \omega_{56} BVE_{t-1} + \varepsilon_{5t} \\
(1.17f) & BVE_t = \omega_{60} + \omega_{66} BVE_{t-1} + \varepsilon_{6t} \\
(1.17g) & v_{it} = \omega_{70} + \omega_{77} v_{it-1} + \varepsilon_{7t} \\
(1.17h) & MVE_t = \alpha_0 + \alpha_1 NI_t^a + \alpha_2 \Delta REC_t + \alpha_3 \Delta INV_t + \alpha_4 \Delta PAY_t + \alpha_5 DEP_t + \\
& \quad + \alpha_6 BVE_t + \alpha_7 v_t + \mu_t
\end{cases}
$$

ΔREC is annual change in receivables, ΔINV is annual change in inventory, ΔPAY is annual change in payables and DEP is the depreciation and amortization expense.

For LIM3, equations [1.17a] through [1.17g] are forecasting equations, and equation [1.17h] is the valuation equation implied by the linear information dynamics of the forecasting equations.

In the next chapter, chapter 2, we present our proposed model based on Ohlson (1995), Feltham and Ohlson (1995), Ohlson (1999) and Barth *et al.* (1999 and 2005).

1.4. Summary and conclusions

The quality of earnings is a summary metric in performance evaluation and a focal question to assess the quality of accounting information.

The literature on earnings quality currently embraces various aspects of this nebulous concept. No unique definition of earnings quality can be found. Different studies focus on just one aspect of earnings quality. Different definitions could therefore be found in the literature and some of them have been cited in this chapter, section 1.2. Aspects often mentioned are the persistence, predictability, variability of earnings (time-series properties of earnings) and the informativeness of earnings.

To synthesize, a high-quality earnings number will reflect current operating performance, being a good indicator of future operating performance, and it accurately annuitizes the intrinsic value of the firm.

Knowing that earnings are important for evaluation effects and the investors see in earnings a valuable information source to assess the firm value, valuation models based on earnings, and based on book value, are viewed typically as an alternative approach to assess the firm value, consequently, Ohlson´s (1995) model and its subsequent refinements by Feltham and Ohlson (1995) and Ohlson (1999) offers a formal link between valuation and accounting numbers.

In summary, the fundamental power lines of the models above presented (Ohlson, 1995; Feltham and Ohlson, 1995; Ohlson, 1999; Barth *et al.*, 1999 and 2005) are:

- The model is centered on the two base accounting variables, book value equity (BVE_t) and earnings, it respects the accounting system properties, namely the clean surplus accounting relation, which being just a mere identity, it is the identity that gives unity to the system;
- The earnings persistence or earnings quality is not only a function of the "conservatism accounting effect" but also a function of the different value relevance of the different earnings components;
- Earnings components have a different value relevance, being accruals component less persistent than cash flows component. In other terms, for the future earnings predictions accruals are less persistent than cash flows (Beaver, 2002);
- "Firm's value equals its book value adjusted for the present value of anticipated abnormal earnings" (Ohlson, 1995: 667). Such value is a function of the accounting value of equity, with unitary coefficient, and of the infinite geometric series of expected abnormal earnings, "unrecorded goodwill", in the authors' terminology or the "market value added", in the proposers of EVA™ terminology;

– The "goodwill equals the present value of the future expected abnormal earnings" and the evaluation can be centered on their prediction (Ohlson, 1995: 662);
– The unrecorded goodwill is defined as the excess of the intrinsic value (market value of equity - MVE_t) in relation to the accounting value (book value of equity - BVE_t), this is, $MVE_t - BVE_t$. In these terms, the goodwill presents itself as a measure for the abnormal earnings generation. As such, goodwill captures all the "hidden assets" as well as the difference between the sum of the cost value of the assets shown on the balance sheet, individually considered, and their market value or the intrinsic value.

Thus, determining the value of the company on accounting and financial variables in a framework of nonlinear relationships presents a high potential for future research. Bernard (1995: 735) noted that:

> *"The Ohlson model represents the base of a branch (for) capital market research … Ohlson (1995) and Feltham and Ohlson (1995) return to "step one" and attempt to build a more solid foundation for further work. Our challenge is clear".*

Chapter 2

Accounting-Based Valuation Model and Earnings Quality

2.1. Introduction

The evaluation is aways based, direct and indirectly, on earnings predictions and the earnings predictions are an important information source both as an evaluation element for management and, as well as, for investors, in other words, for the capitals market.

Knowing that:

– "Ohlson model incorporates the earnings prediction, however, this prediction must be placed in a theoretical duality that underlines the model: evaluating and signalling. This is, firm intrinsic value contains information about earnings quality" (Canadas, 2004: 241).
– And the unrecorded goodwill is defined as the excess of the intrinsic value (market value of equity - MVE_t) in relation to the accounting value (book value of equity - BVE_t), this is, $MVE_t - BVE_t$. In these terms, the goodwill presents itself as a measure for the abnormal earnings generation. As such, goodwill captures all the "hidden assets" as well as the difference between the sum of the cost value of the assets shown on the balance sheet, individually considered, and their market value or the intrinsic value.

Consequently, in this chapter, we describe our linear information model (LIM) structure and its link with the composite measure of earnings quality, namely, the proxies to persistence, predictability and informativeness of the earnings components, it means, the earnings quality measures. Our proposed model is based on the generalized version of the Ohlson (1999) model, which extends the Ohlson and Feltham-Ohlson framework (Ohlson, 1995; Feltham and Ohlson, 1995) and our model allows modelling earnings components, just as in Barth *et al.* (1999 and 2005). In chapter 4, we operationalize this relationship empirically.

2.2. Earnings quality – our rebuilding LIM

It should be noteworthy that we reinterpret rebuilding the base models (Ohlson, 1995; Feltham and Ohlson, 1995; Ohlson, 1999), analyzing them and introducing some modifications, taking into consideration their fundamental power lines, more specifically:

1) Considering the "conservatism accounting effect", introduced by Feltham and Ohlson (1995), which reflects the persistence of the difference between the market value of equity (MVE_t) and book value of common equity (BVE_t), what originates the "unrecorded goodwill", and knowing that this "unrecorded goodwill" can result of an undervaluation of assets and/or of an overestimate expected abnormal earnings;
2) The model examines the earnings quality in terms of value relevance, namely, because it can contemplate the distinction between the permanent and transitory earnings components and the different weighing among them;
3) The information dynamic can be expressed in terms of the profitability rates and it should highlight not the expected earning for the next period but its permanent component, in other words, the one which has relevance in what concerns value;
4) On the linear information dynamic it is highlighted the role of *other information*, in other words, the fact that the accounting values predictions depend of information not present in the current accounting data. The apparently vague and abstract essence of this idea can lead some empirical applications of the model to treat it in an *ad hoc* manner or to neglect it (Barth *et al.*, 1999; Lara *et al.*, 2009; just to mention some studies). However, the potential of this idea is stressed by many authors, so the *other information* variable cannot just be equaled to zero. If the *other information* is ignored, the model according to Ohlson's hypothesis (1995) must produce similar results to the mere capitalization of the accounting price-value or price-earnings ratios, as stated by Lee (1999);
5) The *other information* variable is not directly observed but it can be calculated from the earnings predictions for the next period, as Ohlson (2001) suggests.

In our rebuilding linear information model (LIM), we retain **three main aspects**:

A. First of all, and knowing that, "firm's value equals its book value adjusted for the present value of anticipated abnormal earnings"(Ohlson, 1995: 667) and that, such value is a function of the equity accounting value, with unitary coefficient, in our work the dependent variable of our valuation equations is the market value added ($Dif_{MBV} = MVE_{it} - BV_{it}$), that means, the difference between the current market and book values of common equity. So, we express the valuation function in terms of *goodwill*.

If we consider the valuation formula in line with earnings response coefficient (ERC) literature we can also (re)interpret the β *coefficients* of the valuation equations as a *score* and as that as a *proxy* of the informativeness of market value added, with LIM structure β *coefficients* provide a composite measure of earnings quality (EQ) that simultaneously captures the persistence (ω_{11}, γ_{22}), the predictability (ω_{12}) and the informativeness of earnings (β) and its components, building a composite and three-dimensional measure of earnings quality (EQ). So, our valuation formula is written in terms of market value added, in order to capture in the β *coefficients* the informativeness of earnings. In the next section, section 2.3, "our model development", we explain better the coefficients ω_{11}, ω_{12}, γ_{22} and β.

B. In our linear information dynamic formulation the role of the *other information* (v_{it}) is underlined. In sipte of the vagueness and fuzzy nature of this variable, its potentialities are pointed out by many authors that recognize its importance in the industry-specific or entity-specific treatment of the model. In this sense and knowing that *other information* (v_{it}) is reflected in abnormal earnings, as explained in the previous chapter 1, section 1.3.1, sub-section B, in our study, *other information* (v_{it}) is not defined as a first-order autoregressive process AR(1), but instead as difference between abnormal earnings (x_{it}^a) and the fitted value of abnormal earnings equation that does not include v_{it}, that is, $x_{it}^a - \overline{x_{it}^a}$, where $\overline{x_{it}^{a}}$ is the fitted value of x_{it}^{a} based on a version of abnormal earnings equation that does not include v_{it}.

According to Feltham and Ohlson (1995) and Ohlson (1995), v_{it} captures the extent to which the accounting variables do not explain market value added. Therefore, v_{it} is the difference between two residual income values for the next period. Being certain that the difference between two earnings variables is a earning variable, in the model's context, v_{it} is not just a difference between two earnings variables, it is by itself a earning variable (Canadas, 2004: 237).

C. Third, we also redesign the linear information model (LIM) in order to examine whether differences between the market and book value of common equity (market value added) can be explained by the different value relevance of earnings components: accruals and cash flows. We test if the disaggregation of earnings into cash flow and total accruals (or in the major components of accruals) result in different predictive ability of accounting numbers and the composite measure of arnings quality (EQ) towards market value added, this means, we test if this disaggregation has a different impact in $\beta\, coefficients$ information content.

2.3. Our model development

Following Ohlson (1995), market value of equity, MVE_{it}, is defined as the sum of current equity book value, BVE_{it}, and expected future abnormal earnings, x_{it}^{a}, discounted at a constant rate, r_f (mathematical expression [1.5] presented in chapter 1):

$$[1.5] \qquad MVE_t = BVE_t + \sum_{\tau=1}^{\infty} \frac{E_t\left[x_{t+\tau}^{a}\right]}{\left(1+r_f\right)^{\tau}}$$

And in order to determine whether and to what extent disaggregating earnings provides a composite measure of earnings quality (EQ), we rebuild the relation between MVE_{it}, BVE_{it} and x_{it}^{a}, considering the persistence, in terms of earnings sustainability, the predictability and the informativeness of earnings, which means, taking into account the earnings quality concept.

To achieve our objective, the valuation formula is written in terms of market value added [$\underbrace{(MVE_t - BVE_t)}_{Dif_{MBV}}$], in order to capture in the β *coefficient* (see, the following equation 2.2c) the informativeness of earnings:

$$[2.1] \qquad \underbrace{(MVE_t - BV)}_{Dif_{MBV}} = E_t\left[\sum_{t=1}^{\infty} \frac{x_{t+\tau}^{a}}{(1+r)^{\tau}}\right].$$

As one of our objectives is to obtain a composite measure of earnings quality (EQ), we have to isolate the earnings variables (x_{it}^{a}), in one of the sides of the equation. In this context, the dependent variable will be a measure of the excess between the market value of equity, MVE_{it}, and the equity book value, BVE_{it}.

Our general model comprises three main equations:

$$[2.2] \quad \begin{cases} (2.2a) & x_{t+1}^{a} = \omega_{10} + \omega_{11}x_t^{a} + \omega_{12}x_t + \omega_{13}v_t + \varepsilon_{1t+1} \\ (2.2b) & x_{t+1} = \gamma_{20} + \gamma_{22}x_t + \varepsilon_{2t+1} \\ (2.2c) & \underbrace{(MVE_t - BVE_t)}_{DifMBV} = \beta_0 + \beta_1 x_t^{a} + \beta_2 x_t + \beta_3 v_{it} + \mu_t \end{cases}$$

Equation [2.2a] is the abnormal earnings prediction equation, where abnormal earnings, x_{it}^{a}, is defined in the usual way as earnings less a normal return on equity book value (BVE_t). In our context, as in Barth *et al.* (2005), x_{it} is either accruals or cash flows or four major components of the total accruals.

Equations [2.2a] through [2.2b] are forecasting equations, and equations [2.2c] is our valuation equation: Market value added equation as a function of contemporaneous abnormal earnings, any component of earnings (cash flows, total accruals, or four major components of the total accruals) and *other information* imposing LIM structure, that is:

$$\beta_1 = \frac{\omega_{11}}{R_f - \omega_{11}},$$

$$\beta_2 = \frac{\omega_{12} \times R_f}{\left(R_f - \omega_{11}\right)\left(R_f - \omega_{22}\right)}$$

With $R_f = (1 + r_f)$. R_f is the risk-free return and r_f is a discount rate, which is an intertemporal constant rate.

In chapters 4 and 5 we operationalize our model empirically, and as in Barth *et al.* (2005), we consider three levels of earnings disaggregation based on the Feltham-Ohlson framewok: aggregate earnings, cash flows and total accruals and cash flows and four major components of accruals.

As explained in appendix 5, the signs and magnitudes of the β_j s in [2.2c] depend on the ω s in equations [2.2a] through [2.2b]. The relations among the β_j s and the ω s are complex because of the number of explanatory variables in equation [2.2c], each of which has its own forecasting equation. The signs of β_j s are determined by the signs of ω s. For example, the sign of ω_{12} determines the sign of β_2. Also, the higher the predictive ability of the component for future abnormal earnings, the larger, in absolute value, will be β_2.

2.3.1. Abnormal earnings equation: persistence (ω_{11}) and predictability (ω_{12}) coefficients

Equation [2.2a], allows us to measure the persistence of abnormal earnings. The autoregressive coefficient (ω_{11}) reflects the persistence of abnormal earnings. Prior research (*e.g.*, Dechow *et al.* (1999), Hand and Landsman (1999), Barth *et al.* (1999, 2005)) leads us to predict that ω_{11} is positive. So, the autoregressive coefficient (ω_{11}) is an earnings quality construct that captures the persistence of earnings (earnings sustainability).

The coefficient of the earnings component (x_t), ω_{12}, reflects the incremental effect on the forecast of abnormal earnings of knowing x_t. As we said before, x_t is either accruals or cash flows or four major components of the total accruals, this is, different components of earnings. If all earnings components have the same ability to forecast abnormal earnings, ω_{12} will equal zero, and thus knowing that component of earnings does not aid in forecasting abnormal earnings. In this sense, for us, and similarly with Barth *et al.* (1999, 2005), the coefficient ω_{12} measures the predictability of earnings components. In this context, predictive ability is the ability of current earnings components to predict future earnings.

Barth *et al.* (1999: 208), citing Sloan (1996), argue that "accruals possess less predictive ability with respect to future earnings. The reason is that accruals involve a higher degree of subjectivity than cash flows, are more likely the object of management discretion, and are more apt to contain unusual accruals that are less likely to recur in future periods. Sloan's evidence supports lower predictability of accruals with respect to future earnings". So, in particular, the authors would predict $\omega_{12} < 0$ for accruals and $\omega_{12} > 0$ for cash flows.

2.3.2. Earnings component autoregressive equations: Persistence (ω_{22}) coefficients

Equation [2.2b] describes the autocorrelation, or persistence, of each earnings component[21]. Transitory earnings can be characterized as a process in which ω_{22} = 0, as in Ohlson (1999). For earnings components that are not entirely transitory, the higher ω_{22} is, the more predictable the component will be because we expect accruals and cash flows to be positively auto correlated. We predict ω_{22} > 0 for each component.

2.3.3. Valuation equations: Informativeness or valuation (β) coefficients

Finally, equation [2.2c] is the valuation equation based on the information dynamics in equations [2.2a] through [2.2b]. The goodwill (market value added – Dif_{MBV}) is a growing function of abnormal earnings, whose persistence is measured by the parameter ω_{11}, the bigger ω_{11} is, the bigger β_1 will be. β_2 is the valuation multiple on x_{it}, i.e., accruals or cash flows or four major components of accruals. Analogous to the interpretation of ω_{12} in equation [2.2a], β_2 reflects the incremental effect on valuation from knowing x_t. If both earnings components have the same relation with market value added, β_2 will equal zero, and knowing that component of earnings does not aid in explaining market value added. Thus, if $\beta_1 + \beta_2 = 0$, x_t is irrelevant for valuation. Ohlson labels this condition "value irrelevance". Conversely, if $\beta_1 + \beta_2 \neq 0$, then x_t is "value relevant".

Barth *et al.* (1999: 209) document that: "this positive relation between persistence and value relevance is consistent with predictions made and tested in prior research (*e.g.*, Lipe (1986), Kormendi and Lipe (1987), Barth *et al.* (1990) and Barth *et al.* (1992))".

[21] Ohlson labels "predictability" the autocorrelation, or persistence, of each earnings component expressed in equation [2.2b], but we consider the autocorrelation of each earnings component as persistence. The autoregressive coefficients (ω_{11}, γ_{22}) are an earnings quality constructs that capture the persistence of earnings or the earnings components persistence. For us, and similarly with Barth *et al.* (1999, 2005), the coefficient ω_{12} measure the predictability of earnings components. Predictive ability, the ability of current earnings components to predict future earnings.

β_2 is similarly dependent on the persistence of abnormal earnings ω_{11}, *i.e.*, the higher the persistence of abnormal earnings, the higher is β_2.

The "β *Coefficient*" can be seen, simultaneously, as a type of earnings response coefficient (ERC), that can be used as a measure of earnings information content and as a *proxy* of reported earnings quality. Prior research demonstrates that firms with sustained increases in earnings have higher ERCs than other firms (Barth *et al.*, 1999). Earnings quality concept, in terms of informative content, is a way of assessing the relevance and reliability of earnings, to explain future earnings (Ahmed *et al.*, 2004) or to explain stock returns (Warfield *et al.*, 1995), as we will see in the next chapter, chapter 3, on earnings quality constructs derived from time-series properties (section 3.2).

2.4. Summary and conclusion

Knowing that firm intrinsic value contains information about earnings quality, earnings persistence or earnings quality is a function of the different earnings components value relevance, and earnings or earnings components are important for evaluation effects we proposed, in this chapter, a model which reinterprets rebuilding the link between contemporaneous and future earnings taking into account the tridimensional dimension of the earnings quality concept: persistence, predictability and informativeness.

Our model is based on models presented by Feltham and Ohlson (1995) and Ohlson (1999) which were an extension of the one presented by Ohlson (1995) and it models earnings components just as in Barth *et al.* (2005).

It is noteworthy that the investors see in earnings a valuable information source to assess the firm value, and, earnings quality concept is a way to assess the relevance, the reliability and the informativeness of earnings, in terms of value relevance.

The evaluation is always based on earnings predictions and Ohlson model incorporates this aspect.

In several studies, accruals and cash flows have been established as indicators of earnings quality. Many authors have used abnormal or unexpected accruals to measure earnings quality.

Chapter 3

Earnings Quality: Constructs and Measures

3.1. Introduction

The term earnings quality is a rather nebulous concept, there is not a unique definition for it, as explained in chapter 1, section 1.2. There are various measures and constructs of earnings quality in literature capturing diverse manifestations of earnings quality (Balsam *et al.*, 2003).

The multidimensional nature of the earnings quality concept has given form to a multiplicity of constructs and measures that have been used to approach the earnings quality in academic accounting research and in teaching.

Schipper and Vicent (2003) discuss the classes of earnings quality constructs that have been used in literature and classified them according to four categories that derive from (1) the time-series properties of earnings; (2) the relations among income, cash, and accruals; (3) selected qualitative characteristics in the FASB's Conceptual Framework; and (4) decision implementation.

Another very important study which does a good categorization of the earnings quality studies according to Schipper and Vicent (2003) is the Hermanns (2006), but in this last study the author takes only three categories into account instead of four because Hermanns (2006) considers that category on earnings quality constructs derived from qualitative concepts in the FASB's conceptual framework appears less relevant in an international setting.

The study of Hermanns (2006) analyzes the relation between earnings quality and the audit opinion, her literature review primarily focus on the link between earnings quality and external audit-related elements. In order to provide a better overview on the subject of earnings quality, she also takes into account the studies on earnings quality in general but concerning the finance literature, to keep the review manageable. Secondly, in her opinion the academic research has only superficially investigated the relation between the audit opinion and earnings quality.

In this chapter, we describe the several earnings quality constructs and measures that have been most used and we regroup them in three main categories according to Schipper and Vincent (2003)[22]. Our main categories are: earnings quality constructs that derive from (1) the time-series properties of earnings; (2) the accruals quality; (3) selected qualitative characteristics in the conceptual framework of IASB/FASB.

With the above in mind, in the chapter 6 we develop a measure instrument that allows to delimitate the basic constructs and measures of the earnings quality concept, reviewed in this chapter, through the application of an exploratory multivariate analysis – factor analysis of principal components.

Following, we present a description of our main three categories of earnings quality constructs.

3.2. Earnings quality constructs derived from time-series properties

Time-series constructs associated with earnings quality include persistence, predictability and variability. These three constructs are linked by the properties of the earnings innovation series. Persistence captures the extent to which a given innovation remains in future realizations; predictability is a function of the distribution (especially the variance) of the innovation series; and variability measures the time-series variance of innovations directly. Hermanns (2006) considers an additional measure derived from time-series properties of earnings, namely informativeness of earnings. But neither of those notions looks to be really appropriate to measure earnings quality according to Schipper and Vicent (2003).

[22] We decided to categorize according to this study because to our knowledge this study is the only one that makes a clear categorization of the existing measures of earnings quality. Furthermore their classification is very appropriate and permits to record studies that embrace several subjects in one and that would not be easily classifiable without a redline.

To Williams (2005), there are mainly three determinants of earnings quality. Those are the persistence of earnings, the sustainability of earnings and earnings management. Sustainability means that earnings obtained through recurring activities are considered of better quality than those obtained through nonrecurring activities, like, for example, the sale of a building.

3.2.1. Persistence

Francis *et al.* (2004) document that persistence captures earnings sustainability. Persistent earnings are viewed as desirable because they are recurring (*e.g.*, Penman and Zhang, 2002; Revsine *et al.*, 2002; Richardson, 2003). Analysts sometimes focus on sustainable or recurring earnings (see, for example, AICPA, 1994).

Earnings persistence is, according to Sloan (1996) estimated using a regression. The dependent variable is operating income in year $t+1$ lagged by average total assets. The independent variable is the same but in year t. The auto-correlation coefficient is viewed as a measure of earnings persistence. According to Ahmed *et al.* (2004) earnings persistence is just one measure of earnings quality. According to Schipper and Vicent (2003) persistence is a synonym for sustainable earnings (more permanent and less transitory earnings).

According to Ghosh *et al.* (2005: 34) the persistence of earnings and earnings management are amongst the most frequently used measures of earnings quality (*e.g.*, Dechow and Dichev, 2002). Persistence as an earnings quality construct is derived from a decision usefulness (specifically, an equity valuation) perspective. According to Hermanns (2006), persistence is seen as the degree to which earnings performance persists into the next period and as that, sustainability is a synonym of persistence. In fact, this construct is sometimes discussed in the context of sustainable or core earnings, this means that high-quality earnings are sustainable, that is, “persistent”.

Several researchers (*e.g.*, Kormendi and Lipe, 1987; Easton and Zmijewski, 1989; Collins and Kothari, 1989) have interpreted the slope coefficient in a regression of stock returns on the change and/or level of earnings as a measure of earnings persistence. According to Kormendi and Lipe (1987), persistence of reported earnings has been shown, both theoretically and empirically, to be associated with larger investor responses to reported earnings. This larger response, in turn, is attributed to a larger valuation multiple attached to persistent (*i.e.*, recurring) earnings.

A highly persistent earnings number is viewed by investors as sustainable, that is, more permanent and less transitory. So a given realization from a persistent earnings series is a more readily usable shortcut to valuation by, for example, a price-to-earnings multiple and the earnings number accurately annuitizes the intrinsic value of the firm. Such earnings are referred to as "permanent earnings" in the accounting literature (e.g., Black, 1980; Beaver, 1998; Ohlson and Zhang, 1998).

Lipe (1990) defines persistence in terms of the autocorrelation in earnings: regardless of the magnitude and sign of an earnings innovation, persistence captures the extent to which the current period innovation becomes a permanent part of the earnings series (a random walk is highly persistent and a mean-reverting series has no persistence).

To measure persistence, researchers, such as Sloan (1996) and Richardson *et al.* (2005 and 2006) estimate the following regressions [3.1] and [3.2], see the following table 3.1:

Table 3.1 – Sloan (1996) and Richardson *et al.* (2005 and 2006)

a. A regression of the future value of the variable on its current value.	[3.1] $x_{t+1} = \phi_0 + \phi_1 x_t + \varepsilon_t$ The closer ϕ to 1, the more persistent the variable x_t .
b. A common extension is to decompose total earnings into components and determine whether such a decomposition helps in predicting earnings persistence. The relative performance of cash flows and earnings for predicting future cash flows. γ_1 and γ_2 measure the persistence of the	[3.2] $ROA_{t+1} = \gamma_0 + \gamma_1 (ROA_t - TACC_t) + \gamma_2 TACC_t + v_{t+1}$ Where, ROA - Returns On Assets (ROA) is the *earnings* variable, which is calculate as operating income after depreciation deflated by average total assets.

Table 3.1 – Sloan (1996) and Richardson *et al.* (2005 and 2006)

cash flow component and the accruals component, respectively, as in the following regression [3.2]:	$TACC$ is the total accruals variable. TACC = change in net working capital + change in non-current operating assets + change in net financial assets. Each of those components is deflated by average total assets. $ROA-TACC$ is the cash component variable of earnings. Sloan (1996) and Richardson *et al.* (2005 and 2006) document that $\gamma_1 > \gamma_2$, which implies that the cash flow ($ROA-TACC$) component of earnings is more persistent than the accrual component.

To obtain the relative persistence of accruals, Richardson *et al.* (2005) modify [3.2] regression by simply replacing the cash flow component of earnings by earnings itself. This leads to the following regression:

$$[3.3] \quad ROA_{t+1} = \gamma_0 + \gamma_1(ROA_t) + (\gamma_2 - \gamma_1)TACC_t + v_{t+1}$$

Furthermore, they also conduct a regression on the persistence of the working capital component of accruals, modifying the above regression. In this sense, we can conduct a multivariate regression that includes all the components of accruals.

Following previous research (Lev, 1983; Ali and Zarowin, 1992; Ball and Watts, 1972; Watts and Leftwich, 1977; Francis *et al.*, 2004; Dechow *et al.*, 2010 and Gaio and Raposo, 2010), and in order to develop a measure instrument that allows to delimitate the basic constructs of the earnings quality concept, in chapter 6, we measure earnings persistence as the slope coefficient from a regression of current earnings on lagged earnings, that is, from an autoregressive model of order one (AR1) for annual earnings:

$$[3.1] \quad x_{t+1} = \phi_0 + \phi_1 x_t + \varepsilon_t$$

Values of ϕ_1 close to one imply highly persistent earnings, while values of ϕ_1 close to zero imply highly transitory earnings, in this sense, ϕ_1 captures the persistence of earnings.

According to Wysocki (2006), we also measure earnings persistence as the Pearson correlation between current earnings and next period earnings:

$$[3.4] \quad x_t = \sigma_1 x_{t+1}$$

Wysocki (2006) considers that persistence is the degree to which earnings performance persists into the next period, so, it can be measured as the firm-specific Pearson correlation between current and next period earnings. Values of σ_1 close to one imply highly persistent earnings, while values of σ_1 close to zero imply lower persistent.

3.2.2. Predictability

The FASB's Concepts Statement (1980, n.º 2 §53) refers to predictive ability as an input to an unspecified predictive process. Researchers refer that predictive ability is linked to decision usefulness and it is therefore idiosyncratic to a given user's particular prediction process and goal. However, they sometimes refer to predictive ability specifically as the ability of past earnings to predict future earnings (Lipe, 1990). Lipe (1990) measures earnings predictability from the square root of the error variance based on firm-year specific autoregressive model of order one (AR1) for annual earnings.

Lipe (1990) observes only the predictive ability of the reported earnings series, which, like persistence, is a function of the reporting entity's business model, economic factors, and reporting choices.

However, persistence and predictability in earnings alone are not sufficient to indicate that earnings are high quality. Chamberlain and Anctil (2003) discussed how some accounting rules, such as depreciation treatment, can increase persistence but reduce the usefulness of current earnings as a measure of permanent earnings. Managers often want earnings to be highly persistent and predictable because these characteristics can improve their reputation with analysts and investors.

Predictability is also valued by analysts [see, for example, the AIMR's (1993) description of the distinction between financial reporting and financial analysis] and is an essential component of valuation [see, for example, Lee (1999), for a discussion].

Farinha and Moreira (2007) cited that a set of solutions aiming at directly assessing earnings quality is based on the time-series properties of earnings and earnings components (*e.g.,* Schipper and Vincent, 2003). Amongst the most popular of these components used in empirical research are:

i) **Persistence**, the degree to which earnings performance persists into the next period. This tends to be measured as the firm-specific Pearson correlation between current and next period earnings (Wysocki, 2006);
ii) **Predictive ability**, the ability of current earnings to predict future cash flow from operations. In a similar way as persistence, this tends to be measured as the firm-specific Pearson correlation between current earnings and next period cash flow (Wysocki, 2006).

The main operational limitation of these measures arises from the fact that there is a lot of noise in the correlations when only one period length is taken. Moreover, as Dechow and Schrand (2004) point out, persistence and predictability by themselves are not sufficient evidence to indicate earnings quality given that such characteristics may arise from managers' manipulation.

Following previous research (Lipe, 1990; Dechow *et al.*, 2010 and Gaio and Raposo, 2010), we measure earnings predictability as the square root of the error variance from equation [3.1]. Large (small) values of the square root of the error variance imply less (more) predictable earnings.

According to Wysocki (2006), we also measure earnings predictability as the Pearson correlation between current earnings and next period cash flow:

$$[3.5] \quad x_t = \varphi_1 CFO_{t+1}$$

Wysocki (2006) considers that predictive ability is the ability of current earnings to predict future cash flow from operations. Values of φ_1 close to one imply highly predictable earnings, while values of φ_1 close to zero imply lower predictability. φ_1 is the firm-specific Pearson correlation between current earnings and next period cash flow.

3.2.3. Variability

According to Schipper and Vicent (2003), smoothness, the relative absence of variability, is sometimes associated with high-quality earnings.

Financial analysts and investors view volatility of earnings as undesirable and indicative of a low quality of earnings, so, smoothness is typically seen as a desirable attribute of earnings.

Some authors consider that smoothness is a natural result of accrual accounting. Accruals allow for a better record of real economic transactions (*e.g.*, Dechow, 1994; Dechow *et al.*, 1998), and thereby improve the quality of earnings. However, the use of accruals requires management judgment and estimates, which may introduce measurement error. Managers might also use accruals in an opportunistic way and thereby compromise the quality of earnings.

Hand (1989) and Hunt *et al.* (1996) report evidence consistent with managers' smoothing earnings around some target, although the reason for doing so is not always specified. The SEC Chairman Arthur Levitt (1998) holds that managers smooth earnings because they believe investors prefer smooth increasing earnings. Managers may introduce transitory components to the income series, which reduces earnings quality as captured by persistence, in order to decrease time-series variability, and increase predictability. In addition, artificially smoothed earnings are not representationally faithful to the reporting entity's business model and its economic environment.

Tucker and Zarowin (2006), for example, conclude that smoothness improves earnings informativeness based on an analysis between high and low smoothing group, the high smoothing group is defined as firms that have a stronger negative correlation between discretionary accruals and unmanaged earnings. Collins *et al.* (1994) consider that the high smoothing group has greater earnings informativeness, measured as the extent to which changes in current stock returns are reflected in future earnings.

Nevertheless, the subsequent studies do not provide a clear conclusion on smoothness as a proxy for earnings quality. However, they do lead us to one conclusion, in order to understand the consequences of smoothness in terms of decision usefulness, we will need smoothness measures that better distinguish artificial smoothness from the smoothness of fundamental performance.

Earnings smoothness is, according to Francis *et al.* (2005), the standard deviation of income divided by the standard deviation of operating cash flows. This ratio controls for the underlying cash flow variability. It is measured relatively to a proxy for intrinsic earnings volatility, which in turn is determined by business fundamentals and the economic environment.

Leuz *et al.* (2003) assess two measures of smoothing interventions:

1) The ratio of the standard deviation of operating earnings to the standard deviation of cash from operations (smaller ratios imply more income smoothing);
2) The correlation between changes in accruals and changes in cash flows (negative correlations are evidence of income smoothing). The idea is that changes in cash flows capture the innovation in the unmanaged earnings series, so extreme values of the smoothing measures indicate how much volatility has been removed from the series by means of accruals taken in response to economic shocks. Leuz *et al.* (2003) suggest that the resulting smoothed earnings are less informative as a result of the noise added by management interventions.

Dechow *et al.* (2010: 362) consider that "in the cross-country studies, the commonly used measures of earnings smoothness are a variant of the variability of earnings relative to cash flows from operations $(\sigma(x_t)/\sigma(CFO_t)$ and the correlation between changes in accruals and changes in cash flows from operations $\left(Corr\left(\Delta ACC_t, \Delta CFO_t\right)\right)$. In both cases, cash flow smoothness is the benchmark".

Following previous studies, we use three measures of earnings smoothness. We measure earnings smoothness as:

1) The ratio of the firm-level standard deviation of earnings and the standard deviation of operating cash flows $\sigma(x_t)/\sigma(CFO_t)$, where x_t and CFO_t are both scaled by total assets at the beginning of year t, according to Hunt *et al*. (2000), Thomas and Zhang (2002), Francis *et al.* (2004 and 2005), Leuz *et al.* (2003), Dechow *et al.* (2010) and Gaio and Raposo (2010). Values below one indicate more variability in operating cash flows than in earnings, which implies the use of accruals to smooth earnings. Higher values of the ratio indicate less earnings smoothness. We assume that smoothness is a desirable attribute of earnings, and thus less earnings smoothness implies poorer earnings quality.
2) Using cash flows as the reference construct for unsmoothed earnings, and measure smoothness as the ratio of income variability to cash flow variability, following Leuz *et al.* (2003).
3) The correlation between changes in accruals and changes in cash flows, as in Leuz *et al.* (2003) and Dechow *et al.* (2010). Negative correlations are evidence of income smoothing.

3.2.4. Informativeness of earnings

A measure derived from time-series properties of earnings is the informativeness of earnings. We consider informativeness of earnings as a characteristic of earnings. We have found several articles which analyze the informativeness of earnings and they will be briefly discussed in this part (Warfield *et al.*, 1995; Ahmed, 2004; Gosh and Moon, 2005; among others).

A large body of research demonstrates that accounting numbers and, in particular, earnings have information content. Earnings quality concept, in terms of informative content, is a way to assess the relevance and reliability of earnings, to explain:

- *Stock returns* - Warfield *et al.* (1995) define informativeness as the capacity to explain stock returns. However, earnings appear to explain only a small fraction of the total variation in returns. Imhoff and Thomas (1989), among others, associate quality of earnings to "market valuation" quality. That is, earnings of higher quality are more valued by capital market. In others words, earnings of larger quality have a stronger repercussion in the stock prices than earnings of lower quality.
- *Future earnings* - Ahmed *et al.* (2004) see informativeness in the sense of information content with respect to future earnings.

Different explanations of the weak association between earnings and returns, have been offered, see table 3.2.

Table 3.2 – The association between earnings and returns

Author	**Considerations about the association earnings *versus* returns**
Beaver *et al.*, 1980.	Earnings do not reflect the underlying economic events in a timely manner and, therefore, are not synchronized with stock price movements.
Collins *et al.*, 1994.	The distinction between *timeliness* and *noise in earnings*, is not linear.
Givoly and Hayn, 1993; Gonedes, 1975; Hoskin *et al.,* 1986; Ramesh and Thiagarajan, 1993; Ramakrishnan and Thomas, 1998; Ronen and Sadan, 1981.	Earnings contain transitory components that are either value-irrelevant or should have only a limited valuation impact.
Kormendi and Lipe, 1987.	Cross-sectional tests fail to recognize the time-series properties of individual firms' earnings, a factor likely to be incorporated by investors in projecting future earnings and returns.
Kothari, 1992.	Certain specifications of the earnings variable (levels *versus* changes, deflation by price or earnings, etc.) also appear to have an effect on the measured earnings response coefficient.
Hayn, 1995; Barth et *al.*, 1992 ; Collins *et al.*, 1997 ; Collins *et al.*, 1999.	Reported losses are perceived by investors as temporary. They are thus more weakly associated with returns than profits.

Table 3.2 – The association between earnings and returns

Author	Considerations about the association earnings *versus* returns
Subramanyan and Wild, 1993.	The informativeness of earnings is inversely related to various characteristics that *proxy* for the likelihood that the firm will be terminated.
Dhaliwal and Reynolds, 1994.	The strength of the return-earnings association is inversely related to the default risk of the firm The liquidation option plays an important role on earnings informativeness and on explaining the relationship between earnings per share and returns. The main explanation for the low information content of losses appears to be that shareholders have the option to liquidate the firm, namely when the current losses are projected to perpetuate if the firm continues to operate. So the liquidation option is relevant for stock valuation and earnings informativeness.

According to Canadas (2004: 244), “markets appreciate differently the persistence of earnings, depending on its sign (negative or positive) and magnitude. In fact, losses (negative earnings) have a smaller impact in the market value than profits (positive earnings) of the same magnitude. The losses are not related with the growth expectations, since they are noticed as more transitory than profits (convexity in earnings valuation)”. If losses reflect the return expectations or the expectations of future cash flows the option would be to liquidate (liquidation option), to abandon (Berger *et al.*, 1996), or to adapt, in the sense of projects changes, as in Burgstahler and Dichev (1997).

Financial analysts and academic researchers use various criteria and signals to assess the quality of reported earnings. Such quality assessments appear to affect investor decisions. In this scenario - quality of earnings in terms of informative content for investors and other stakeholders - the earnings response coefficient (ERC) have been used as a measure of earnings quality. Prior research demonstrates that firms with sustained increases in earnings have higher earnings response coefficients (ERCs) than other firms (Barth *et al.*, 1999). In this sense, earnings response coefficient (ERC) appears as a measure of earnings information content and as a proxy of reported earnings quality.

Ghosh and Moon (2005) use earnings response coefficients (ERC) as a measure of investors' perception of earnings quality.

A) Earnings response coefficient

The earnings response coefficient (ERC) is the relative variation of the stock value (or price) in relation to the relative variation of a measure of earnings:

$$ERC = \frac{\dfrac{P_t - P_{t-1}}{P_{t-1}}}{\dfrac{x_t - x_{t-1}}{x_{t-1}}}$$

Where,

P_t is the per-share price and x_t is an earnings variable.

B) Econometric regression specification of ERC

To analyse the association between earnings and stock prices or market values we can use return or prices models. The general model, equation [3.6], defines the relation between accounting information and market value, as follows:

$$[3.6] \quad V = f(A, v)$$

Where,

V - a variable representing some market measure of value;
A - any vector of accounting variables, such as earnings per share;
v - any vector of information other than information in accounting numbers.

In table 3.3, we present some alternative specifications of the relationship between prices and earnings that have been used in empirical accounting research and the corresponding interpretations of the earnings response coefficient (ERC).

Table 3.3 – Some specifications of ERC in empirical accounting research

Independent variable	Dependent variable	Earnings Response Coefficient (ERC)
x_{it}	P_{it}	Pure multiplier of earnings. If the independent term is null this multiplier is the price-earning ratio (PER). If the price coincides with the accounting value in euros, ERC will equate Return On Equity (ROE).
x_{it}	P_{it}/P_{it-1}	Forecast change in the stock return when earnings change a monetary unit.
$(x_{it}-x_{it-1})$	$(P_{it}-P_{it-1})$	Forecast change in the stock prices (of a period with regard to the previous) produced by a monetary unit of earnings change.
$(x_{it}-x_{it-1})/x_{it-1}$	P_{it}/P_{it-1}	Forecast change in the stock return produced by a change of 1% in earnings.
$(x_{it}-x_{it-1})/x_{it-1}$	$(P_{it}-P_{it-1})/P_{it-1}$	ERC indicates the relative change of the stock price when earnings change 1%.
$\sum_{t=1}^{n} x_{it}$	$(P_{it}-P_{it-n})/P_{it-n}$	Effect of the accumulated earnings on the total long term return of stocks.
UX_{IT}	UR_{IT}	Magnitude in that a unit of earnings not waited for a period affects the non expected return, that is, the difference among the real and forecast return.
x_{it}/P^{*}_{it-1}	$(P_{it}-P_{it-1})/P_{it-1}$	This model was estimated by Hayn (1995). ERC indicates the relative change of the stock price when the earnings vary a unit. The measure of earnings is deflected for the last stock price verified in the end of the previous fiscal year, to consider the dimension of the firms and to reduce the heterocedasticity that is generated in this type of relationships.
In the previous models, P_{it} represents the last stock price of the month of March of the year $t+1$ for the firms i; x_{it} represents the earnings levels for the period t; UX_{it} represent not waited earnings of the period t; UR_{it} is the return not waited in the period; $RET_{it}=\frac{P_{it}-P_{it-1}}{P_{it-1}}$ is the stock return during a period of 12 months, with beginning in the end of the third month after the terminus of the fiscal year $t-1$; P^{*}_{it-1} is the stock price at the end of fiscal year $t-1$, that is to say, the value in euros for firm stock at the beginning of the year t.		

Partially adapted from González (1998)

In chapter 6, in order to develop a measure instrument that allows to delimitate the main earnings quality dimensions, we use the following regressions ([3.7], [3.8] and [3.9]) to estimate de earnings response coefficient (ERC) as a measure of informativeness:

$$[3.7] \quad RET_{it} = \alpha_0 + \beta \; EARN_{it} + \varepsilon_{it}$$

$$[3.8] \quad RET_{it} = \alpha_0 + \beta \; \Delta EARN_{it} + \varepsilon_{it}$$

$$[3.9] \quad RET_{it} = \alpha_0 + \beta \frac{\Delta EARN_{it}}{EARN_{it-1}} + \varepsilon_{it}$$

Where,

$RET_{it} = \dfrac{P_{it} - P_{it-1}}{P_{it-1}}$ is the firm i's 12-month return after the end of fiscal year t. P_{it} is the last stock price in the end of fiscal year t. $EARN_t$ is firm i's net income before extraordinary items in year t, scaled by market value (MVE_{it}) at the beginning of year t. $\Delta EARN_{it}$ is firm i's change in net income before extraordinary items of firm i between year $t-1$ and year t, scaled by market value (MVE_{it}) at the beginning of year t. MVE_{it} is the market value equity. ε_{it} and ζ_{it} are the random disturbance term and $i = 1, ..., N \; Firms$ and $t = 1, ..., T \; Period$.

In the above regressions ([3.7], [3.8] and [3.9]), β, the slope coefficient, is the earnings response coefficient (ERC): a measure of earnings information content and, as so, a proxy to earnings quality.

The earnings response coefficient (β) indicates the relative change in stock price when earnings-per-share varies a monetary unit. The measure of earnings is deflated by the stock price at the end of fiscal year, in order to consider the firms size and to reduce the heterocedasticity that happens in this type of relationships.

3.3. Accruals quality

The accruals quality is an important earnings quality construct. Several approaches to assessing earnings quality take the view that earnings that map more closely into cash are more desirable (*e.g.*, Penman, 2001). Accruals quality stands for mapping of accounting earnings into cash flows (Francis *et al.*, 2005).

In the vast existing literature on accruals models, there are several definitions of accruals: total accruals (or normal accruals), current accruals, operating accruals, total net accrual, abnormal accruals or extreme accruals or discretionary accruals, working capital accruals, accruals relating to financing activities, accruals relating to investing activities, assets and liabilities accruals, and so on. In appendix 2, we present a table with different definitions of accruals and different types of accruals.

However and despite the huge diversity of definitions about accruals, it can be said that accruals are generally defined as the difference between the published earnings (net income) and the cash flow. In other words, they represent the derived cumulative effect of introducing the accrual basis of accounting. This way, the general mathematical expression for the definition of total accruals (ACC_{it}) for the company i on the period t is this:

$$[3.10] \quad ACC_{it} = Earnings_{it} - Cash\ Flows_{it}$$

The accruals include two important components:

1. A short term component or change in non-cash working capital accruals $(\Delta Non-Cash\ Working\ Capital)$, which correspond to the working capital variation. The change in non-cash working capital is equal to the change in accounts receivable (ΔREC_{it}) plus the change in inventories (ΔINV_{it}), plus the change in other current assets (ΔCA_{it}) minus the change in current liabilities (ΔCL_{it}).
2. And a long term component which corresponds to the depreciations, depletions and amortizations (DEP_{it}).

As a result the ACC_{it} of a company i in the period t can also be calculated according to the following expression:

$$[3.11]\quad ACC_{it} = \underbrace{\left(\Delta REC_{it} + \Delta INV_{it} + \Delta CA_{it} - \Delta CL_{it}\right)}_{\Delta Non-Cash\ Working\ Capital} - DEP_{it}$$

Where,
ACC_{it} is an aggregate measure of total accruals; ΔREC_{it} is change in accounts receivables (WS 02051); ΔINV_{it} is change in inventories; ΔCA_{it} is change in current assets; ΔCL_{it} is change in current liabilities; DEP_{it} is the depreciation, depletion and amortization; $i = 1,...,N\ Firms;\ t = 1,...,T\ Period$.

In turn, total accruals are composed of non-discretionary and discretionary components. The accruals are not discretionary in the whole, and because of this, a part of them depend on a series of factors beyond management control, such as the accounting standard itself or the changes on the company's economical conditions. Researchers, usually separate discretionary components from total accruals by subtracting non-discretionary accruals, to examine the degree of earnings management.

Discretionary accruals are considered a combined discretionary measure applied by management and it has been used in several studies in order to detect the presence of earnings management. According to Guay *et al.* (1996) and Francis *et al.* (2005) abnormal accruals are accruals introduced by management to achieve specific earnings outcomes. Abnormal accruals are a synonym of discretionary accruals.

An important problem of this approach is the difficulty in separating total accruals into discretionary and non-discretionary components. This way, the methodology used by in most works with the objective to isolate both components of total accruals (discretionary and non-discretionary) consists of establishing a set presuppositions about normal behaviour of accruals in the absence of incentives for its normal or non-discretionary component. Thus, once the normal component of accruals (non-discretionary accruals) are estimated, it is compared to the total accruals (ACC), extracting by difference its discretionary component.

In the next table, table 3.4, we summarize the most widely used accruals models[23]:

Table 3.4 – Summary of widely used models of accruals

Accrual model	Comments
Healy (1985) model: [3.12] $DACC_{it} = ACC_{it} / TA_{it-1}$	The Healy model (1985) defines the estimated discretionary accruals ($DACC_{it}$) for company i during period t as being the total accruals (ACC_{it}) divided by the total assets in the beginning of the period (TA_{it-1}). This model constitutes the simplest measure to estimate the accruals discretionary component since Healy (1985) uses the total accruals as discretionary accruals proxy without establishing an estimation model that separates discretionary and non-discretionary accruals components. The specification proposed by Healy (1985) assumes that the expected non discretionary accruals for the period are zero and because of this any value different from zero for the total or observed accruals results from management discretion.
DeAngelo (1986) model: [3.13] $DACC_{it} = \Delta ACC_{it} / TA_{it-1}$	The DeAngelo model (1986) puts aside the possibility of using total accruals as proxy for discretionary accruals. The author considers that the ACC_{it} variable, in many cases, could be negative due to the period's amortization (DEP_{it}). Consequently, the empirical observation of some negative total accruals could lead to incorrect conclusions. Thus, it is assumed that the expected non-discretionary accruals of a period (t) are equal to those of the previous period ($t-1$), for which any observed difference on total accruals between the $t-1$ period and t is attributed to intentional practises of "earnings management". This way, to DeAngelo the estimated discretionary accruals correspond to the first differences in the total accruals, deflated by the assets' total in the beginning of the period. Like Healy (1985), the DeAngelo model maintains the characteristic of considering non-discretionary accruals constant over time.
Dechow and Sloan (1991) model: [3.14] $ACC_{it} / TA_{it-1} = \alpha_0 + \alpha_1 Median_{It}\left(ACC_{it} / TA_{it-1}\right) + \varepsilon_{it}$	The industry's model developed by Dechow and Sloan (1991) uses, among others, the $Median_{It}\left(ACC_{it} / TA_{it-1}\right)$ variable which represents the total accruals median, deflated by the total assets of the previous period, of industry I during period t. This model breaks with the restrictive assumption that the accruals normal component is maintained constant over time. However, instead of directly modelling the non-discretionary accruals, the model assumes that the variation on the discretionary accruals determinants is common to all companies belonging to the same industry or sector, in other words, it assumes that each company accruals are sensitive to the accruals of the industry in which they are inserted.

[23] For a more detailed analysis of accruals model, see, for example, Mendes *et al.* (2011).

Table 3.4 – Summary of widely used models of accruals

Accrual model	Comments
Jones (1991) model: [3.15] $ACC_{it}/TA_{it-1}=\alpha_0(1/TA_{it-1})+\alpha_1(\Delta REV_{it}/TA_{it-1})+$ $+\alpha_2(PPE_{it}/TA_{it-1})+\varepsilon_{it}$	Jones (1991) also breaks with the assumption that the accruals non-discretionary component is constant overtime. Jones Model is an accrual expectation model, which intends to estimate the portion of accruals that managers intentionally used to achieve some pre-determined level of reported earnings (discretionary accruals). *Discretionary accruals* are used as an indicator of earnings quality. The Jones model is a direct estimation model that identifies accounting (economic) fundamentals as the determinants of normal or non-discretionary accruals. According to Jones (1991), abnormal accruals tend to reflect lower earnings quality. Jones (1991) estimates the proposed equation [3.15] through the Ordinary Least Squares – OLS method, using the largest temporal series of available data for each company of the sample. The prediction errors of the model represent the level of abnormal or discretionary accruals, corresponding to the difference between the observed accruals and the estimate of their non-discretionary component.
Modified Jones model (Dechow *et al.*, 1995) [3.16] $ACC_{it}/TA_{it-1}=\alpha_0(1/TA_{it-1})+\alpha_1(\Delta REV_{it}/TA_{it-1}$ $-\Delta REC_{it}/TA_{it-1})+\alpha_2(PPE_{it}/TA_{it-1})+\varepsilon_{it}$	Dechow *et al.* (1995) propose a modified version of the Jones Model (1991) with the purpose of eliminating the existing source of error in the estimate of discretionary accruals when the manipulation is exerted through sales. The coefficients and non-discretionary accruals estimate for each company of the sample during the estimate period corresponds to the one obtained by the original Jones Model, nevertheless, an adjustment to the model is made on the period in which the earnings management hypothesis is assumed, being the sales variation adjusted by the variation in receivables**.** Therefore, if the results manipulation is done through sales, this model will detect better the manipulation.
Dechow and Dichev (2002) model [3.17] $TCA_{it}/TA_{it}=\alpha_0(CFO_{it-1}/TA_{it})+\alpha_1(CFO_{it}/TA_{it})+$ $+\alpha_2(CFO_{it+1}/TA_{it})+\varepsilon_{it}$	The model of Dechow and Dichev (2002) propose and test a measure of earnings quality that captures the mapping of current accruals into last-period, current-period, and next-period cash flows. This model provides a direct link between cash flows and current accruals and captures both intentional and unintentional accruals estimation error by management, and this is considered as an inverse measure of earnings quality. This model is a direct estimation of accruals-to-cash relations. The regression residuals (ε_{it}) reflect the accruals which are not related with the realized cash flows and the standard deviation of these residuals $(\sigma(\varepsilon_{it}))$ is used as an accruals quality measure of each company in which a high standard deviation implies low earnings quality. In this sense, $\sigma(\varepsilon_{it})$ or absolute ε_{it} proxies for accrual quality as an unsigned measure of extent of accrual "errors".

Table 3.4 – Summary of widely used models of accruals

Accrual model	**Comments**
McNichols (2002) model [3.18] $TCA_{it}/TA_{it} = \alpha_0 (CFO_{it-1}/TA_{it}) + \alpha_1 (CFO_{it}/TA_{it}) +$ $+\alpha_2 (CFO_{it+1}/TA_{it}) + \alpha_3 (\Delta REV_{it}/TA_{it}) + \alpha_4 (PPE_{it}/TA_{it}) + \varepsilon_{it}$	McNichols (2002) considers that the Dechow and Dichev (2002) model certainly constitutes an incomplete non-discretionary accruals measure, therefore he argues the need to relate the Dechow and Dichev (2002) earnings quality analysis to the discretionary accruals study proposed by Jones (1991) model. As a result, the author proposes a new specification that combines the original Dechow and Dichev (2002) model to the explanatory variables proposed by Jones (1991), being all variables divided by the total assets in the beginning of the period.
Performance matched (Kothari *et al.*, 2005) model [3.19] $ACC_{it}/TA_{it-1} = \alpha_0 (1/TA_{it-1}) + \alpha_1 (\Delta REV_{it}/TA_{it-1}) +$ $+\alpha_2 (PPE_{it}/TA_{it-1}) + \alpha_3 ROA_{it} + \varepsilon_{it}$	Kothari *et al.* (2005) propose an extension to Jones (1991) and Modified Jones (1995) models which incorporates a company's performance measure due to fact that some previous studies (Dechow *et al.*, 1995; Guay *et al.*, 1996) concluded that the models based on the Jones proposal are poorly specified for companies' samples with extreme financial situations. With the goal of controlling the financial-economical performance effect of companies in earnings management tests, Kothari *et al.* (2005) added the return on assets variable (ROA_{it}) to the Jones (1991) and Modified Jones (1995) models as an additional regressor. As a result, Performance Matched model matches firm-year observation with another from the same industry and year with the closest ROA. Discretionary accruals are from Jones model (or Modified Jones model).

ACC_{it} is an aggregate measure of total accruals; $DACC_{it}$ is an aggregate measure of estimated discretionary accruals; TCA_{it} is an aggregate measure of total current accruals (or working capital accruals); TA_{it} is the total assets; REV_{it} is the net sales or revenues; REC_{it} is the receivables; DEP_{it} is the depreciation, depletion and amortization; CFO_{it} is cash flows or funds from operations; PPE_{it} is the property, plant and equipment; ROA_{it} is the return on assets; ε_{it} is the residual of the regression; $i = 1,...,N\ Firms$; $t = 1,...,T\ Period$.

According to several authors (*e.g.*, Dechow *et al.*, 1995; Guay *et al.*, 1996; Young, 1999; Thomas and Zhang, 2000), it is widely accepted in the literature that the available aggregate accrual models do have shortcomings and may not work very well in identifying earnings management practices, so, in this sense, and based on Farinha and Moreira (2007), we can point out some critics to the aggregate accruals models (see table 3.5):

Table 3.5 – Critics point out to aggregate accruals models

Author	**Critics**
Dechow *et al.* (1995)	The models are misspecified and their power is very low.
Guay *et al.* (1996)	The models can be imprecise in estimating abnormal (discretionary) accruals.
Young (1999)	A systematic error related to factors like growth, cash flow, leverage and earnings smoothing is documented in such accruals estimates.
Thomas and Zhang (2000)	All models tend to perform poorly in terms of forecasting accuracy.

Based on Farinha and Moreira (2007)

These limitations explain why most accounting studies tend to simultaneously use two or more models or sometimes other solutions to detect earnings management not directly based on accruals. Nevertheless and in spite of the a wide range of accrual models which have been developed in the literature, from a simple random-walk of total accruals (DeAngelo, 1986) to econometrically more sophisticated specifications, the comparative assessment of accrual estimates derived from different models (*e.g.* Thomas and Zhang, 2000) does not show meaningful differences between those from "sophisticated" and "unsophisticated" models. So, this is probably the main reason why a quite simple solution, like Jones (1991) model, has remained popular for more than a decade amongst the models that deal with aggregate accruals. This model still has a leading role in the literature, being one of the most used in empirical research (e.g. Peasnell *et al.*, 2000). In fact, we have not, yet, alternative models able to overcome its limitations and, simultaneously, easy to use.

Dechow *et al.* (1995) review various models that have been proposed in the literature. The most frequently used and effective methods are the Jones (1991) model, and the modified-Jones model (Dechow *et al.*, 1995), which is more powerful at detecting sales-based manipulations than the original Jones (1991) model. Earnings quality is then defined as the absolute value of the discretionary component, the larger its value, the lower is the quality of earnings. However, these models are subject to limitations, which affect the conclusions of the empirical results.

Jones model (1991), later modified for example by Dechow *et al.* (1995), and the model of Dechow and Dichev (2002) are considered as the leading studies in this accrual quality category.

In our empirical work about multidimensional nature of the earnings quality concept (see chapter 6), we consider four accruals quality measures: two of the four accruals quality measures based on more unsophisticated models, for example, a simple random-walk of total accruals (*e.g.*, Healy, 1985 and DeAngelo, 1986) and the others two accruals quality measures rely on more econometrically sophisticated specifications, such as, Dechow and Dichev (2002) model.

Based on Healy (1985), we use the following ratio in order to measure de magnitude of accruals, extreme discretionary accruals are low quality because they represent a less persistent component of earnings :

$$[3.12]\quad DACC_{it} = \frac{ACC_{it}}{TA_{it-1}}$$

Where,
$DACC_{it}$ is an aggregate measure of discretionary accruals; ACC_{it} is an aggregate measure of total accruals defined as earnings less cash flows from operations $\left(ACC_{it} = x_{it} - CFO_{it}\right)$, where x_t is calculated as net income before extraordinary items/preferred dividends (NI_{it}) and CFO_{it} is cash flows from operations of the several firms i for the period t, is the funds from operations Worldscope item; ACC_{it} is scaled by Total Assets; $i = 1,\ldots,N\ Firms$; $t = 1,\ldots,T\ Period$.

Another accrual quality measure that we consider is based on DeAngelo (1986), we use the following ratio in order to measure the changes in total accruals, high values of the discretionary accruals ratio imply higher changes in total accruals and provide lower earnings quality:

$$[3.13]\quad DACC_{it} = \frac{\Delta ACC_{it}}{TA_{it-1}}$$

Where,
ΔACC_{it} is changes in total accruals and total accruals (ACC_{it}) are defined as previously.

And, finally, the two anothers accruals quality measures are derived from Dechow and Dichev (2002) model, hereafter referred as DD. The DD model is based on the extent to which working capital accruals map into cash flow realizations, where a poor match means low accruals quality. Therefore, we regress working capital accruals on prior, current, and future cash flows from operations:

$$[3.17] \quad TCA_{it}/TA_{it-1} = \alpha_0 + \alpha_1 CFO_{it-1}/TA_{it-1} + \alpha_2 CFO_{it}/TA_{it-1} + \alpha_3 CFO_{it+1}/TA_{it-1} + \varepsilon_{it}$$

Where,
TCA_{it} is an aggregate measure of total current accruals (working capital accruals) of the several firms i for the period t; CFO_{it} is firm i's cash flow from operations in year t. All variables are scaled by total assets at the beginning of year t (TA_{it}); $i = 1, ..., N\ Firms;\ t = 1, ..., T\ Period.$

Working capital accruals in year t are:

$$[3.20] \quad TCA_{it}/TA_{it-1} = \Delta CA_{it}/TA_{it-1} - \Delta CL_{it}/TA_{it-1} - \Delta CASH_{it}/TA_{it-1} + \Delta STDEBT_{it}/TA_{it-1}$$

Where,
ΔCA_{it} is firm i's change in current assets between year $t-1$ and year t; ΔCL_{it} is firm i's change in current liabilities between year $t-1$ and year t; $\Delta CASH_{it}$ is firm i's change in cash between year $t-1$ and year t; and $\Delta STDEBT_{it}$ is firm i's change in debt in current liabilities between year $t-1$ and year t; $i = 1, ..., N\ Firms;\ t = 1, ..., T\ Period.$

Cash flows from operations in year t is:

$$[3.21] \quad CFO_{it}/TA_{it-1} = NI_{it}/TA_{it-1} - \left(\Delta CA_{it}/TA_{it-1} - \Delta CL_{it}/TA_{it-1} - \Delta CASH_{it}/TA_{it-1} + \Delta STDEBT_{it}/TA_{it-1} - DEP_{it}/TA_{it-1}\right)$$

Where,
NI_{it} is firm i's net income extraordinary items in year t and DEP_{it} is firm i's depreciation and amortization expense in year t, and the other variables are as defined before; $i = 1, ..., N\ Firms;\ t = 1, ..., T\ Period.$

After estimating equation [3.17] for each firm i, we compute our accruals quality measures as the standard deviation of residuals $\left(\sigma\left(\varepsilon_{it}\right)\right)$ and the absolute residuals values (ε_{it}). Consistent with the construction of the other metrics, larger absolute residuals and larger standard deviations of residuals suggest poorer earnings quality, because less of the variation in current accruals is explained by operating cash flow realizations. Since earnings are the sum of accruals and cash flows, and the cash flow component is normally considered to be objective and less manipulated, the quality of earnings depends on the quality of accruals. Therefore, poorer accruals quality implies a lower level of earnings quality. On the other hand, these measure can be interpreted in the sense that when variations in accruals are not explained by (past, current or future) cash flows (thus the higher the standard deviation of the firm-specific regression residuals, the lower the earnings quality), this results in lower earnings quality.

Dechow and Dichev model (2002) is distinct from Jones model but nevertheless related. They claim that the quality of accruals and earnings is inversely related to the magnitude of accrual estimation errors. Their model is thus based on the premise that earnings quality is affected by measurement and estimation errors in accruals (it thus concerns one aspect of earnings quality). According to McNichols (2002), more precisely in Dechow and Dichev (2002) model earnings quality is the magnitude of estimation errors in accruals (inverse measure of earnings quality). Their measure of accrual quality relates to the match between working capital accruals and operating cash flow realisations, more precisely to what extent accruals map into cash flow realisations. A poor match is synonymous of low accrual quality. Their model thus provides a direct link between cash flow and accruals.

3.4. Earnings quality constructs derived from qualitative concepts in the IASB/FASB's conceptual framework

The conceptual framework of the International Accounting Standards Board (IASB) was approved by the International Accounting Standards Committee (IASC) Board in April 1989 for publication in July 1989, and adopted by the IASB in April 2001. In September 2010, as part of a bigger project to revise, improve and converge the conceptual framework of the IASB and of the Financial Accounting Standards Board (FASB), was approved the new conceptual framework which sets out the concepts that underlie the preparation and presentation of financial statements for external users and led the IASB to review the objective of general purpose financial reporting and the qualitative characteristics of useful information. The remaining of the IASB document from 1989 remains effective.

The IASB/FASB's conceptual framework deals with the objective of financial reporting, the qualitative characteristics of useful financial information, the definition, recognition and measurement of the elements from which financial statements are constructed and the concepts of capital and capital maintenance.

From the IASB/FASB's conceptual framework: "the objective of general purpose financial reporting is to provide financial information about the reporting entity that is useful to existing and potential investors, lenders, and other creditors in making decisions about providing resources to the entity. Those decisions involve buying, selling, or holding equity and debt instruments and providing or settling loans and other forms of credit." (IASB/FASB, 2010, Chapter 1, § 2).

According to the conceptual framework, earnings quality refers to the attributes of earnings information that make information useful for decisions. "The qualitative characteristics of useful financial information identify the types of information that are likely to be most useful to the existing and potential investors, lenders, and other creditors for making decisions about the reporting entity on the basis of information in its financial report (financial information)" (IASB/FASB, 2010, Chapter 3, §1).

Over the years, much time and effort has been spent on trying to delineate the qualitative characteristics that are determinant in information usefulness. The conceptual framework focuses on decision usefulness, defined in terms of relevance and faithful representation (fundamental qualitative characteristics), and comparability, verifiability, timeliness and understandability, as the criterion for enhance the usefulness of information that is relevant and faithfully represented, that is, assessing quality. Those two concepts (fundamental qualitative characteristics) form a whole and cannot be separately measured.

The challenge for researchers is to make these attributes empirically operational. Researchers have measures such as cash flows, to draw inferences about attributes such as relevance and reliability (actually, faithful representation) (*e.g.*, Dechow, 1994).

Barth *et al.* (2001) interpret both explanatory power and estimated coefficients from these regressions as capturing the combined relevance and reliability of the earnings information, or other financial report information, considered.

Barua (2006) develops a measure of earnings quality in line with the primary qualitative characteristics specified in the Statement of Financial Accounting Concepts (SFAC) No. 2 (FASB, 1980): relevance and reliability. More specifically, he derives a summary measure of earnings quality by applying factor analysis on fifteen different variables representing different components of relevance and reliability dimensions. He provides a validation of the earnings quality construct by testing whether the construct reflects decision usefulness to investors, which he operationalizes by using a value relevance approach and a cost of capital analysis.

Furthermore, the role of the IASB Board and the FASB Foundation is to create reporting standards but the researcher works with the reported numbers and not the standards. Consequently, some authors not take this category into account (*e.g.*, Hermanns, 2006).

In our empirical work about multidimensional nature of the earnings quality concept (chapter 6), we consider, following the previous literature, three market-based earnings attributes: value relevance, earnings timeliness and earnings conservatism. Following we define and present the constructs of these market-based earnings attributes.

3.4.1. Relevance

Throughout the literature, the concept of relevance has emerged as the primary qualitative characteristic of useful information. For information to be useful, it must be relevant for decision making. Information is relevant when it can influence the decisions of users by helping them assess the financial impact of past, present or future transactions and events. It is also relevant when it confirms, or corrects, previous assessments.

Information that helps users to predict future income and cash flows is also relevant. To be relevant, information should have predictive value or feedback value or both, and information should be provided in a timely manner. According to the IASB/FASB' conceptual framework (2010, chapter 3, §7): "Financial information is capable of making a difference in decisions if it has predictive value, confirmatory value, or both".

Prior studies in accounting (*e.g.*, Ball and Brown, 1968; Lev, 1989; Lev and Zarowin, 1999; Barth *et al.*, 2001) suggest that the value relevance approach can be employed to assess usefulness of accounting information, this is, usefulness of earnings information can be assessed by the association between returns and earnings. They label the decline in association as a decrease in usefulness of financial information because such association reflects consequences of investors' actions.

In the same sense, Barth (1991) compared relevance and reliability of alternative accounting measures by examining the relationship between alternative measures and market values. In a debate on "relevance of value-relevance research", Barth *et al.* (2001) suggest that the value relevance approach measured both relevance and reliability because accounting information will be reflected in the price when the information is relevant and reliable to investors. The authors interpret both explanatory power and estimated coefficients from these regressions as capturing the combined relevance and reliability of the earnings information, or other financial report information, considered.

This construct is often measured as the ability of earnings to explain variation in returns, where greater explanatory power is viewed as desirable. One stream of this research interprets value relevance as a direct measure of decision usefulness (*e.g.*, Joos and Lang, 1994; Collins *et al.*, 1997; Francis and Schipper, 1999; Lev and Zarowin, 1999).

Value relevance construct is often measured as the ability of earnings to explain variation in returns. In this sense, and following previous studies (*e.g.*, Collins *et al.*, 1997; Francis and Schipper, 1999; Bushman *et al.*, 2004; Francis *et al.*, 2004; Barth *et al.*, 2001; Gaio and Raposo, 2010), we use four measures of value relevance (see appendix 4 about summary of earnings quality measures and chapter 6). We measure value relevance as the explanatory power (adjusted R^2) of earnings level or/and earnings change for returns, considering to the following regressions:

$$[3.7]\quad RET_{it} = \alpha_0 + \beta\ EARN_{it} + \varepsilon_{it}$$

$$[3.8]\quad RET_{it} = \alpha_0 + \beta\ \Delta EARN_{it} + \varepsilon_{it}$$

$$[3.9]\quad RET_{it} = \alpha_0 + \beta\ \frac{\Delta EARN_{it}}{EARN_{it-1}} + \varepsilon_{it}$$

$$[3.22]\quad RET_{it} = \delta_0 + \delta_1 EARN_{it} + \delta_2 \Delta EARN_{it} + \zeta_{it}$$

Where,

$RET_{it} = \dfrac{P_{it} - P_{it-1}}{P_{it-1}}$ is the firm i's 12-month return after the end of fiscal year t. P_{it} is the last stock price in the end of fiscal year t; $EARN_t$ is firm i's net income before extraordinary items in year t, scaled by market value (MVE_{it}) at the beginning of year t. $\Delta EARN_{it}$ is firm i's change in net income before extraordinary items of firm i between year $t-1$ and year t, scaled by market value (MVE_{it}) at the beginning of year t. MVE_{it} is the market value equity. ε_{it} and ζ_{it} are the random disturbance term and $i = 1,\ldots, N\ Firms$ and $t = 1,\ldots,T\ Period$.

The explanatory power, this is, the adjusted R^2 of the above regressions ([3.7], [3.8], [3.9] and [3.22]), is our measure of value relevance, where greater explanatory power is viewed as desirable. Smaller values of adjusted R^2 imply lower value-relevant earnings and therefore poorer earnings quality. The value relevance of earnings (that is, the ability of earnings to explain variations in returns or prices) is a desirable attribute, as it is usually seen as a direct measure of the decision usefulness of earnings.

An additional aspect of relevance is the significance or materiality of information to decision makers. Users are interested in information that may affect their decision making. Materiality is an important concept for the disclosure of information because its meaning can differ greatly among stakeholders. For example, a consideration can be material because a large stakeholder considers a particular issue to be important. Alternatively, specific risks associated with governance, environmental and social issues can be more material for companies in one industry than in another. It is clear that materiality requires the exercise of professional judgment in the particular circumstances

3.4.2. Timeliness and Conservatism

Timeliness requires that current information be made available to interested parties because the usefulness of information for decision-making purposes declines as time elapses. For information to be useful for decision making, decision makers have to receive it while it is still relevant; that is, before it loses its capacity to influence decisions.

These two attributes (timeliness and conservatism) derive from the view that accounting earnings is intended to measure economic income, defined as changes in market value of equity (see, for example, Ball *et al.*, 2000). The reference construct for both measures is stock returns:

- *Timeliness* is the explanatory power of a reverse regression of earnings on returns and conservatism is the ratio of the slope coefficients on negative returns to the slope coefficients on positive returns in a reverse regression of earnings on returns;

- *Conservatism* therefore differs from timeliness in that it reflects the asymmetry ability of accounting earnings to reflect economic losses (measured as negative stock returns) versus economic gains (measured as positive stock returns). Combined timeliness and conservatism are sometimes described as “transparency”, a desirable attribute of accounting earnings (see, for example, Ball *et al.*, 2000). Watts (2003a,b) presents several arguments supporting the view that conservatism is a desirable attribute of earnings; broadly speaking, these arguments derive from the asymmetric costs of overpayments versus underpayments to firm stakeholders and the role of conservative reporting in constraining such payments.

Following previous studies (Ball *et al.*, 2000; Raonic *et al.*, 2004; Bushman *et al.*, 2004; Francis *et al.*, 2004; Dechow *et al.*, 2010; Gaio and Raposo, 2010), we compute our measures of earnings timeliness and earnings conservatism using the regression [3.23], which use earnings as the dependent variable and returns measures as independent variables:

$$[3.23] \quad EARN_{it} = \alpha_0 + \alpha_1 NEG_{it} + \beta_1 RET_{it} + \beta_2 NEG_{it} * RET_{it} + \zeta_{j,t}$$

Where ,
NEG_{it} is a dummy variable which takes the value 1 or 0, $NEG_{it} = 1$ if $RET_{it} < 0$ and $NEG_{it} = 0$ otherwise, and the other variables are as defined before.

One of our measure of earnings timeliness is the explanatory power (adjusted R^2) of the above regression [3.23], higher values of timeliness imply more timely earnings and higher earnings quality. Earnings that reflect the information incorporated in stock returns more quickly are seen by investors as being of higher quality.

Another measure of earnings timeliness, that we considered, is the value of the β_1 coefficient in the above regression [3.23]. A higher β_1 implies more timely recognition of the incurred losses in earnings. Timely loss recognition represents high quality earnings.

In chapter 6, we measure earnings conservatism in terms of the asymmetric incorporation into earnings of economic losses (measured as negative stock returns) and economic gains (measured as positive stock returns). Following Basu (1997), Pope and Walker (1999), Givoly and Hayn (2000), Francis *et al.* (2004), Dechow *et al.* (2010) and Gaio and Raposo (2011), our earnings conservatism measure is derived from equation [3.23] , it is the negative of the ratio of the coefficient on bad news to the coefficient on good news, as follows:

$$\text{Conservatism} = -{(\beta_1 + \beta_2)}/{\beta_1}$$

Higher values of conservatism imply lower conservative earnings and a poorer quality of earnings. Conservative accounting is expected to reveal information that managers might have incentives to hide otherwise, so investors usually see conservatism as a desirable attribute of earnings.

3.5. Conclusion

The multidimensional nature of the earnings quality concept has given form to a multiplicity of constructs and measures. Due to the fact that no unique definition of earnings quality exists, a multitude of measures coexist. In this chapter, we classify the dimensions of earnings quality in three main cateogories:

(1) The time-series properties of earnings;
(2) The accrual quality;
(3) Selected qualitative characteristics in the conceptual framework of IASB/FASB.

Earnings of high quality can be defined as earnings that are persistent/sustainable and informative. Persistence has to be understood in the sense that current earnings provide a good indication of future earnings, capturing the extent to which a given innovation remains in future realizations, that is, it is characterized as the ability to maintain earnings in the long-term, or having permanent rather than transitory earnings. We consider sustainability as a synonym of persistence, which means that earnings obtained through recurring activities are considered of better quality than those obtained through nonrecurring activities. Predictability is a function of the distribution, especially the variance, of the innovation series. Variability measures the time-series variance of innovations directly. Informativeness on the other hand has been defined by Ahmed *et al.* (2004) in the sense of information content with respect to future earnings, or in the terms of Warfield *et al.* (1995), as the capacity of earnings to explain stock returns.

Throughout the vast literature on the earnings quality there is a large diversity of metrics and proxies for measuring earnings quality, therefore, and according to our literature review in appendix 3, we present a summary of the more popular earnings quality measures reviewed in this chapter. These measures are important for our empirical work about multidimensional nature of the earnings quality concept, in chapter 6.

Chapter 4

Accounting-Based Valuation Model: A Composite Measure of Earnings Quality

4.1. Introduction

Although the boundaries of financial reporting are changing, the objective of general objective financial reporting is still to provide financial information about the reporting entity that is useful to present and potential equity investors, lenders, and other creditors in making decisions in their capacity as capital providers. This primary goal of financial reporting is recognized by the FASB and the IASB in their Conceptual Framework (FASB and IASB, 2010). Users try to optimize their economic decisions in terms of return and risk, or in terms of equity values. So, the usefulness of accounting information imposes that an accounting model is also an accounting based valuation model. However the *gaap* provide little guidance as to how the amounts are to be used.

As outlined in chapter 1, section 1.3.1, accounting-based valuation models based on the Ohlson or the Feltham–Ohlson framework provide a foundation for the relation between financial statement data and firm value. Accounting-based valuation models incorporating accounting accruals based on the Feltham-Ohlson framework provide the guidance as to how the financial statement amounts are to be used. We use this framework to provide empirical evidence on our research hypotheses presented in the next section 4.2. Besides that, the framework Feltham-Ohlson (Feltham and Ohlson, 1995) recognizes that the difference between current market value of equity (MVE) and book value of common equity (BVE) of the company can subsist for long periods of time. This difference is the reflex of the persistence of the expected abnormal return, of the conservatism accounting effect and of the *other information* (ν_t) that is quickly incorporated into the prices but only later is reflected in the financial statements (*lack of timeliness*).

The main objective in this chapter is to test empirically our model, described in chapter 2, and to test whether and to what extent disaggregating earnings, imposing linear information structure of accounting numbers, provides a composite measure of earnings quality (EQ) that simultaneously captures the persistence and the *informativeness* of earnings.

The chapter is organized as follows. The next section 4.2. develops some hypotheses. The research design and the predictions error test are described in section 4.3. Section 4.4 describes the sample and data, and results are discussed in section 4.5. Section 4.6 summarizes and concludes the chapter.

4.2. Development of the hypotheses

As explained in chapter 2, our model centers on the analysis of the relation between contemporaneous and future earnings, in line with the linear information dynamics. We use the framework in Ohlson (1999), which extends the Ohlson and Feltham-Ohlson framework (Ohlson, 1995; Feltham and Ohlson, 1995) by modelling earnings components, just as in Barth *et al.* (1999 and 2005). This modelling extension suggests that the value relevance of an earnings component depends on:

- Its ability to predict future abnormal earnings; and
- The persistence of the component.

Starting from this rationale, in our work we rebuild the relation between contemporaneous and future earnings and we redesign the linear information model (LIM) structure of accounting information considering the earnings quality concept, that is, to the persistence, in terms of sustainability of earnings, to the predictability of earnings, and to the different value relevance of earnings components (accruals and cash flow). To achieve our objective, the valuation formula is written in terms of market value added, in order to capture in the β *coefficient* the informativeness of earnings.

We examine whether differences between the market and book value of common equity (market value added) can be explained by the different value relevance of earnings components: accruals and cash flow. We test if the disaggregation of earnings into cash flow and total accruals, and total accruals into its four major components, has different impact in β *coefficients* information content (LIM2 and LIM3 in the research design).

We designate, in the research design (next section 4.3), three types of disaggregation of earnings: First linear information model (LIM1), second linear information model (LIM2) and third linear information model (LIM3):

- The LIM1 only retains the abnormal earnings;
- The LIM2 test the disaggregation of earnings into cash flow and total accruals;
- The LIM3 comprises the disaggregation of earnings into cash flow and total accruals into its four major components: changes in receivables (ΔREC_{it}), changes in inventory (ΔINV_{it}), changes in payables (ΔPAY_{it}) and depreciation and amortization expense (DEP_{it}).

Finally and in line with previous works of Hayn (1995), attending to the convexity of earnings, we test our relations in a subset of valuation relevance, that is, when there are abnormal earnings (NI_{it}^{a}>0). In that, we avoid the dampening effect of the loss cases on the measures of information content of earnings and on the prediction of contemporaneous market value added.

In this sense, in this work our objective is to verify the following four hypotheses (H_1 to H_4):

H_1: Whether imposing linear information model (LIM) structure is important to draw inferences from valuation equations based on residual income models.

H_2: Imposing linear information structure, contemporaneous market value added (and as that, equity values) provide a composite measure of earnings quality (EQ) that simultaneously captures the persistence, the predictability and the *informativeness* of earnings

H_3: Disaggregating earnings into cash flow[24] and total accruals (or in the major components of accruals) result in different predictive ability of accounting numbers and of the composite measure of earnings quality (EQ) towards market value added.

H_4: The information content of the composite measure of earnings quality (EQ) is bigger when avoiding the dampening effect of losses.

[24] We define cash flows as cash flows from operations, and use the terms interchangeably.

A large body of research demonstrates that accounting numbers and, in particular, earnings have information content. Earnings quality concept in terms of informative content is a way to assess the relevance and reliability of earnings. However, earnings appear to explain only a small fraction of the total variation in returns. According to Beaver *et al.* (1980) earnings do not reflect the underlying economic events in a timely manner and, therefore, are not synchronized with stock price movements (*lack of timeliness*). Collins *et al*. (1994) consider that the distinction between *timeliness* and *noise* in earnings is not linear. And other authors consider that reported losses are perceived by investors as temporary. Losses are thus more weakly associated with returns than profits (Hayn, 1995; Barth et *al.*, 1992; Collins *et al*., 1997; Collins *et al.*, 1999).

According to several researchers (Hayn, 1995; Collins *et al.*, 1997; Collins *et al.*, 1999), markets appreciate differently the persistence of earnings depending on its sign, negative or positive. In fact, losses (negative earnings) have a smaller impact in the market value than profits (positive earnings) of the same magnitude. The losses are not related with the growth expectations, since they are noticed as more transitory than profits (convexity in earnings valuation). If losses reflect the return expectations or the expectations of future cash flows the option would be to liquidate (liquidation option), to abandon (Berger *et al.*, 1996), or to adapt, in the sense of projects changes, as in Burgstahler and Dichev (1997).

According to Barth *et al.* (1999: 222), "prior research finds that Ohlson model valuation estimates differ for firms with positive and negative earnings". This is predictable from the Ohlson model given that negative earnings is less persistence than positive earnings (*e.g.*, Hayn, 1995; Collins *et al.* (1997), Collins *et al.* (1999)).

In agreement with this idea, the above models are initially applied to the totality of the earnings variables values, positive and negative values and later the models are only applied to the positive values for the earnings variables, in order to analyze the differences (tables 4.16, 4.17 and 4.18).

4.3. Research design

4.3.1. Linear information models (LIMs)

The redesign of the linear information model (LIM) structure of accounting information considering the earnings quality concept will allow us to capture the persistence, informativeness and predictability of the earnings components, building a composite and tridimensional measure of earnings quality (EQ) (ω, β and γ).

Our first linear information model (LIM1) comprises the next two equations:

[4.1a] $$NI_{it}^{a} = \omega_{10} + \omega_{11} NI_{it-1}^{a} + \omega_{12} v_{it} + \varepsilon_{1it}$$

[4.1b] $$\underbrace{\left(MVE_{it} - BVE_{it}\right)}_{Dif_{MBV}} = \beta_0 + \beta_1 NI_{it}^{a} + \beta_2 v_{it} + \mu_{it}$$

Where,

NI_{it}^{a} is abnormal earnings, defined as earnings minus the normal return on equity book value (BVE_{it} is the common equity, WS[25] 03501), $NI_{it}^{a} = NI_{it} - r \times BVE_{it-1}$, where r is a discount rate, which is an intertemporal constant rate[26]. The earnings variable is calculated as net income before extraordinary items/preferred dividends (NI_{it}, WS 01551). MVE_{it} is the market value equity (WS 08001). Dif_{MBV} is the market value added ($Dif_{MBV} = MVE_{it} - BV_{it}$), that means, the difference between the current market and book values of common equity. v_{it} is the *other information* and it is defined as the difference between abnormal earnings $\left(NI_{it}^{a}\right)$ and the fitted value of abnormal earnings equations does not include v_{it}, that is, $NI_{it}^{a} - \overline{NI_{it}^{a}}$, where $\overline{NI_{it}^{a}}$ is the fitted value of NI_{it}^{a} based on a version of abnormal earnings equation that does not include v_{it}. ε_{1it} and μ_{it} are the random disturbance term and $i = 1,...,N\ Firms$ and $t = 1,...,T\ Period$. All variables are sacled by total assets (TA_{it}, WS 02999).

Equation [4.1a] allows us to measure the persistence of abnormal earnings. The autoregressive coefficient (ω_{11}) is an earnings quality construct that captures the persistence of abnormal earnings. Persistence in earnings are viewed as desirable because they are recurring (*e.g.*, Penman and Zhang, 2002; Revsine *et al.*, 2002; Richardson, 2003). Analysts sometimes focus on sustainable or recurring earnings. According to Hermanns (2006), persistence is seen as the degree to which

[25] "WS" means World Scope item. In appendix 1, we present a variables description.

[26] In our work, we used the 10-years benchmark bond (euro area) as a proxy for risk-free rate because is the most frequently used. We calculated an average value of the "10-years benchmark bond (euro area)" during the time period related to our data, 1990-2009. However, there are different ways of calculating the discount rate and the literature on the subject is extensive. In appendix 4, we briefly present some explanations about it.

earnings performance persists into the next period and as that, sustainability is a synonym of persistence. So, the autoregressive coefficient (ω_{11}) is an earnings quality construct that captures the persistence of earnings (earnings sustainability).

Prior research, namely, Dechow *et al.* (1999), Hand and Landsman (1999) and Barth *et al.* (1999, 2005) leads us to predict that ω_{11} is positive.

Equation [4.1b] is our valuation equation: market value added equation as a function of contemporaneous abnormal earnings and other information imposing LIM structure, that is: $\beta_1 = \omega_{11}/(R-\omega_{11})$, β_1 is dependent on the persistence of abnormal earnings (ω_{11}), the higher ω_{11} is, the higher β_1 will be.

The β_1 coefficient, in valuation equation [4.1b], can be seen as a type of earnings response coefficient (ERC), that can be used as a measure of earnings information content and as a proxy of reported earnings quality. Earnings quality concept, in terms of informative content, is a way to assess the relevance and reliability of earnings, to explain future earnings (Ahmed *et al.*, 2004) or to explain stock returns (Warfield *et al.*, 1995).

For LIM2, equations [4.2a] through [4.2b] are forecasting equations, and equation [4.2c] is our valuation equation: Market value added equation as a function of contemporaneous abnormal earnings, total accruals, one component of earnings, and *other information* imposing linear information model (LIM) structure[27].

[4.2a] $$NI_{it}^{a} = \omega_{10} + \omega_{11} NI_{it-1}^{a} + \omega_{12} ACC_{it-1} + \omega_{13} v_{it} + \varepsilon_{1it}$$

[4.2b] $$ACC_{it} = \gamma_{20} + \gamma_{22} ACC_{it-1} + \varepsilon_{2it}$$

[4.2c] $$\underbrace{\left(MVE_{it} - BV_{it}\right)}_{Dif_{MBV}} = \beta_0 + \beta_1 NI_{it}^{a} + \beta_2 ACC_{it} + \beta_3 v_{it} + \mu_{it}$$

[27] As in Barth *et al.* (1999 and 2005), the second linear information model (LIM2) relaxes the assumption that the total accruals and cash flow components of earnings have the same model parameters. According to Barth *et al.* (2005: 316) "(…) permitting a different coefficient for total accruals in equations [4.2a] and [4.2c] implicitly permits the coefficients of the other components of earnings, which primarily comprises cash flow (*i.e.*, ω_{11} and β_1) to differ from those on accruals (*i.e.*, $\omega_{11} + \omega_{12}$ and $\beta_1 + \beta_2$)".

Where,
ACC_{it} is total accruals, defined as earnings (NI_{it} ,WS 01551) minus cash flows from operations (CFO_{it} , WS 04201). MVE_{it} is the market value equity (WS 08001), and the other variables are as defined before. All variables are scaled by total assets (TA_{it} , WS 02999).

While autoregressive coefficient (ω_{11}) is an earnings quality construct that captures the persistence of earnings (earnings sustainability), just as we analyzed previously, the coefficient ω_{12} measures the predictability of earnings, this is, the predictability of accruals. For us, and similarly with Barth *et al.* (1999 and 2005), the coefficient ω_{12} measure the predictability of earnings components. Predictive ability, the ability of current earnings components to predict future earnings.

The coefficient of the earnings component (in our study, accruals component), ω_{12}, reflects the incremental effect of the earnings component on the forecast of abnormal earnings. The earnings components are accruals and cash flows, if all earnings components have the same ability to forecast abnormal earnings, ω_{12} will equal zero, and thus the component of earnings does not aid in forecasting abnormal earnings.

Knowing that Sloan (1996)'s evidence supports that accruals possess less predictive ability with respect to future earnings because accruals involve a higher degree of subjectivity than cash flows and they are more object of management discretion, we predict that $\omega_{12} < 0$ for accruals and $\omega_{12} > 0$ for cash flows.

The equations [4.2c] is an accruals autoregression. Following the autocorrelation, or persistence, of each earnings component. According to Lipe (1990), we define this construct as the ability of earnings to predict itself. We expect accruals to be positively auto correlated, so, we predict $\gamma_{22} > 0$. Transitory earnings can be characterized as a process in which $\gamma_{22} = 0$, as in Ohlson (1999).

The third linear information model (LIM3) comprises six equations. Thus, relative to the second linear information model (LIM2), by adding three additional forecasting equations, LIM3 imposes additional assumptions relating to the valuation parameters. In LIM3, as in Barth *et al.* (2005), we disaggregated the total accruals variable into its major components (receivables, inventories, payables and depletion, depreciation and amortization) because we expect them to have different implications for forecasting abnormal earnings and market value added:

[4.3a] $NI_{it}^{a} = \omega_{10} + \omega_{11}NI_{it-1}^{a} + \omega_{12}\Delta REC_{it-1} + \omega_{13}\Delta INV_{it-1} + \omega_{14}\Delta PAY_{it-1} + \omega_{15}DEP_{it-1} + \omega_{16}v_{it} + \varepsilon_{1it}$

[4.3b] $\Delta REC_{it} = \omega_{20} + \omega_{22}\Delta REC_{it-1} + \omega_{23}\Delta INV_{it-1} + \omega_{25}DEP_{it-1} + \omega_{26}v_{it} + \varepsilon_{2it}$

[4.3c] $\Delta INV_{it} = \omega_{30} + \omega_{32}\Delta REC_{it-1} + \omega_{33}\Delta INV_{it-1} + \omega_{34}\Delta PAY_{it-1} + \omega_{35}DEP_{it-1} + \varepsilon_{3it}$

[4.3d] $\Delta PAY_{it} = \omega_{40} + \omega_{43}\Delta INV_{it-1} + \omega_{44}\Delta PAY_{it-1} + \varepsilon_{4it}$

[4.3e] $DEP_{it} = \omega_{50} + \omega_{55}DEP_{it-1} + \varepsilon_{5it}$

[4.3f] $\underbrace{(MVE_{it} - BV_{it})}_{Dif_{MBV}} = \beta_0 + \beta_1 NI_{it}^{a} + \beta_2\Delta REC_{it} + \beta_3\Delta INV_{it} + \beta_4\Delta PAY_{it} + \beta_5 DEP_{it} + \beta_6 v_{it} + \mu_{it}$

Where,
ΔREC_{it} is the firm i's change in receivables between year $t-1$ and year t (receivables, WS 02051); ΔINV_{it} is the firm i's change in inventories between year $t-1$ and year t (inventories, WS 02101); ΔPAY_{it} is the firm i's change in payables between year $t-1$ and year t (accounts payable, WS 03040); DEP_{it} is the firm i's depletion, depreciation and amortization expense in year t (depreciation, depletion and amortization, WS 01151), and the other variables are as defined before. To provide insight into the relative size of each accrual component, all of them (receivables, inventories, payables and depreciation, depletion and amortization) are divided by total revenues (REV_{it}, WS 01001). ε_{it} and μ_{it} are aleatory disturbance term; $i = 1,...,N$ *Firms*; $t = 1,...,T$ *Period*.

For linear information model 3 (LIM3), equations [3.3b] through [3.3e] specify a prediction equation for each component. Consistent with Ohlson (1999), each component is assumed to follow an autoregressive process. Thus, each component prediction equation includes the lagged value for that component. According to Ohlson (1999) and findings in Barth *et al.* (1999 and 2005), we predict $\omega_{ij} > 0$ for each component.

In appendix 5, we develop the algebraic relation between the valuation coefficients and the forecasting equation coefficients for linear information model (LIM) structure with the disaggregation of earnings into cash flow and total accruals into its four major components, we have appointed for this LIM disaggregation: LIM3. This derivation of valuation coefficients for LIM3 in terms of the ω_{jk} is similar to Ohlson (1995), Myers (1999) and namely Barth *et al.* (2005).

The first accrual component, change in receivables (ΔREC_{it}), reflects information about current sales and cash receipts. We expect that change in receivables can be positively or negatively related to future sales and thus to future earnings. Change in receivables can be positively related to future sales because, in line with previous studies, we consider that current sales are positively related to future sales (Barth *et al.*, 2005; and Stober, 1992). However, change in receivables can be negatively related to future sales because change in receivables is negatively related to cash receipts. According to Barth *et al.* (2005: 336) "this negative relation occurs because low current cash receipts can be an indication that product demand will decrease in the future due to general economic conditions". In this sense, the receivables prediction equation, equation [4.3b], includes the lagged value of receivables and also includes change in inventories, ΔINV_{it}, and depletion, depreciation and amortization expense (DEP_{it}) because each of these earnings components predicts future sales, which in turn affect future change in receivables. Based on Barth *et al.* (2005: 340), the receivables prediction equation "does not include change in payables (ΔPAY_{it}) because we expect any relation between change in payables and future change in receivables associated with future sales to be captured by change in inventory".

The second accrual component, change in inventories (ΔINV_{it}), can also be positively or negatively related to future sales. An increase (decrease) in inventories could result from higher (lower) expected future sales, assuming constant inventory costs, and as with receivables, we predict that current sales are positively related with future sales. On the other hand, an increase in inventories could be an indication of unexpectedly low demand and in this sense, change in inventories (ΔINV_{it}) is negatively related to future sales. Additionally, increases in inventory can reflect increases in factor input prices, which results in higher current expenses and lower current earnings, so, current expenses predict future expenses and we can predict that increases in inventory are negatively associated with future earnings.

The inventory prediction equation, equation [4.3c], includes change in receivables (ΔREC_{it}) and depletion, depreciation and amortization expense (DEP_{it}) because these variables predict future sales, as in equation [4.3b]. On the other hand, equation [4.3c] also includes change in payables (ΔPAY_{it}) because payables are used to purchase inventory and we expect that change in payables predict future change in inventory.

The third accrual component, change in payables (ΔPAY_{it}), can also be positively or negatively related to future sales. Increases in payables can reflect increases in inventory attributable to purchases, and in this sense, change in payables are positive indicators of future sales increases. However, considering inventory purchases constant, increases in payables can reflect increases in factor input prices, which result in higher current expenses and lower current earnings, so, current expenses predict future expenses and we can predict that increases in payables are negatively associated with future earnings. We expect that change in inventory predict future change in payables, thus the payables prediction equation, equation [4.3d], includes the change in inventory (ΔINV_{it}).

According to Barth *et al.* (2005: 337) and Feltham and Ohlson (1996), we predict that the final accrual component of earnings, depletion, depreciation and amortization expense (DEP_{it}) is positively associated with future sales because "management increases purchases of noncurrent assets in anticipation of increased production, and increases in noncurrent assets result in higher depreciation. Although depreciation and amortization expense reduces earnings, management would not invest without expecting a positive return on its investment". The depletion, depreciation and amortization expense prediction equation, equation [4.3e], includes only its lagged variable because we not expect any earnings component to have any first-order predictive ability for depletion, depreciation and amortization.

4.3.2. Prediction error tests

In order to test our third hypothesis, whether earnings disaggregation result in different predictive ability and aids in predicting market value added, we compare prediction errors across the three linear information models (LIMs), both when the linear information model (LIM) structure was imposed and when it was not.

In some econometrics contexts forecasting is the prime objective: one wants estimates of the future values of certain variables to reduce the uncertainty attaching to current decision making. In order contexts where real-time forecasting is not the focus prediction may nonetheless be an important moment in the analysis. For example, out-of-sample prediction can provide a useful check on the validity of an econometric model[28]. "Prediction" need not be a matter of actually projecting into the

[28] As discussed by Peter Pope, cited by Barth *et al.* (2005), the out-of-sample predictions are not forecasts.

future but in any case it involves generating fitted values from a given model, in this way, after the estimation of parameters, a common use of regression is for prediction. The term “postdiction” might be more accurate but it is not commonly used, we talk about prediction when there is no true forecast in view, so, in this sense, it is necessary at this point to make a largely semantic distinction between “prediction” and “forecasting”. We will use the term “prediction” to mean using the regression model to compute fitted values of the dependent variable, either within the sample or for observations outside the sample (Greene, 2008).

According to Greene (2008: 101) “various measures have been proposed for assessing the predictive accuracy of forecasting models [see, for example, Theil (1961) and Fair (1984)]”. Most of these measures are designed to evaluate ex post forecasts, that is, forecasts for which the independent variables do not themselves have to be forecasted.

Having obtained a series of fitted values, we used a GRETL code[29] which produces a vector of statistics that characterize the accuracy of the predictions (univariate forecast evaluation statistics).

Some commonly used measures are the mean error (ME), mean absolute error (MAE), root mean squared error (RMSE), mean percentage error (MPE) and mean absolute percentage error (MAPE). These measures will reflect the model’s ability to track turning points in the data. These are defined as follows:

$$\text{[4.4a]} \quad ME = \frac{1}{T}\sum_{t=1}^{T} e_t \qquad \text{[4.4b]} \quad MAE = \frac{1}{T}\sum_{t=1}^{T} |e_t|$$

$$\text{[4.4c]} \quad RMSE = \sqrt{\frac{1}{T}\sum_{t=1}^{T} e_t^2} \qquad \text{[4.4d]} \quad MPE = \frac{1}{T}\sum_{t=1}^{T} 100\frac{e_t}{y_t}$$

$$\text{[4.4e]} \quad MAPE = \frac{1}{T}\sum_{t=1}^{T} 100\frac{|e_t|}{y_t}$$

Where,
y_t is the value of a variable of interest at time t and f_t is a forecast of y_t. We define the forecast error as $e_t = y_t - f_t$. T is the number of periods being forecasted. Given a series of T observations and associated forecasts we can construct several measures of the overall accuracy of the forecasts. Note that both of these measures are backward looking in that they are computed using the observed data on the independent variable.

[29] We are also very grateful to Professor Pedro Bação at FEUC that helped us to develop the GRETL code which produces the vector of “predictions” statistics.

If there is any one static that normally takes precedence over the others, it is the root mean squared error (RMSE) within the estimation period. The root mean squared error (RMSE) is measured in the same units as the data, rather than in squared units, and is representative of the size of a “typical” error. Root mean squared error (RMSE) is a frequently used measure of the differences between values predicted by a model or an estimator and the values actually observed from the thing being modelled or estimated. Root mean squared error (RMSE) is a good measure of accuracy. These individual differences are also called residuals, and the root mean squared error (RMSE) serves to aggregate them into a single measure of predictive power.

The mean absolute error (MAE) is also measured in the same units as the original data, and is usually similar in magnitude to, but slightly smaller than, the root mean squared error. The mean absolute error (MAE) is an easier statistic to understand than the root mean squared error (RMSE).

The mean absolute percentage error (MAPE) is also often usefull for purposes of reporting, because it is expressed in generic percentage terms which will make some kind of sense even to someone who has no idea what constitutes a “big” error. The mean absolute percentage error (MAPE) can only be computed with respect to data that are guaranteed to be strictly positive.

The mean error (ME) and mean percentage error (MPE) that are reported in some statistical procedures are signed measures of error which indicate whether the forecasts are biased, i.e., whether they tend to be disproportionately positive or negative. Bias is normally considered a bad thing, but it is not the bottom line. Bias is one component of the mean squared error, in fact mean squared error equals the variance of the errors plus the square of the mean error.

There is no absolute criterion for a “good” value of root mean squared error (RMSE) or mean absolute error (MAE): it depends on the units in which the variable is measured and on the degree of forecasting accuracy, as measured in those units, which is sought in a particular application. It makes no sense to say “the model is good (bad) because the root mean squared error is less (greater) than x”, unless we are referring to a specific degree of accuracy that is relevant to our forecasting application.

When comparing regression models that use the same dependent variable and the same estimation period, the root mean squared error goes down as adjusted R-squared (R^2) goes up. Hence, the model with the highest adjusted R-squared (R^2) will have the lowest root mean squared error, and we can just as well use adjusted R-squared (R^2) as a guide.

The above statistics have an obvious scaling problem – multiplying values of the dependent variable by any scalar multiplies the measure by that scalar as well. Several measures that are scale free are based on the Theil U statistic[30]:

$$[4.4f] \quad U = \sqrt{\frac{(1/T)\sum_i (y_t - \hat{y}_t)^2}{(1/T)\sum_t y_t^2}}$$

This measure is related to R-squared (R^2) but is not bounded by zero and one. Large values indicate a poor forecasting performance. We also use this measure (Theil U statistic) in order to corroborate our conclusions.

So, the bottom line is that we should put the most weight on the error measures in the estimation period, most often the root mean squared error (RMSE), but sometimes mean absolute error (MAE) or mean absolute percentage error (MAPE), when comparing among models. But we should keep an eye on the validation-period results, residual diagnostic tests, and qualitative considerations such as the intuitive reasonableness and simplicity of our model. The residual diagnostic tests are not the bottom line, we should never choose model A over model B merely because model B more “ok’s” on its residual tests. A model which fails some of the residual tests or reality checks in only a minor way is probably subject to further improvement, whereas it is the model which flunks such tests in a major way that cannot be trusted.

Finally, if two models are generally similar in terms of their errors statistics and other diagnostics, we should prefer the one that is simpler and/or easier to understand. The simpler model is likely to be closer to the truth, and it will usually be more easily accepted by others[31].

[30] See Theil (1961) and Fair (1984).

[31] It is important to remember the K.I.S.S. rule: Keep it simple…

4.4. Data and sample

4.4.1. Sample selection

Our sample consists of all domestic listed firms from 11 European countries that are required to prepare consolidated financial statements (France, Portugal, Spain, Belgium, Holland, Italy, Greece, Lithuania, Romania, United Kingdom and Irland).

We obtained data for 1990–2009 from the *Thomson Datastream and WorldScope – Global Research Annual Industrial Files.* All companies were selected in based on the information available in the database.

We excluded financial institutions (bank institutions and insurance companies) due to the differences in theirs patrimonial nature and in order to ensure that the accruals components on which we focused were meaningful for our sample firms. For example, inventory is not a predictor of future earnings for financial institutions.

Our sample is an incomplete panel or an unbalanced panel because in collecting data on European listed firms over time, we found that some firms have dropped out of the maket while new entrants emerged over the sample period observed. So, throughout this study the panel data are assumed to be incomplete due to randomly missing observations and because the number of observations differs among panel members. Incomplete panels are more likely to be the norm in typical economic empirical settings[32].

As the empirical tests require three consecutive years of data, the sample is constituted by the firms that have at least three consecutive years of financial and accounting information.

Knowing that market value added ($Dif_{MBV} = MVE_{it} - BV_{it}$) is our proxy for goodwill, it is the difference between the current market and book values of common equity, and if Dif_{MBV} is positive, the firm has added value, if it is negative, the firm has destroyed value. For our study, we are only interested in positive market value added, which means goodwill observations, so, in this sense, we

[32] "Complete panels" or "balanced panels" are the cases where the individuals are observed over the entire sample period. If each cross-sectional unit has the same number of time series observations, then such a panel (data) is called a balanced panel.

removed of the sample all observations with negative book values equity and negative market value added.

We treat as missing observations those that are in the extreme top and bottom first percentile, as in Kothari and Zimmerman (1995), Collins *et al.* (1997), Barth *et al.* (1999 and 2005).

All variables, including equity market value, were measured as of end of fiscal year and are expressed in millions of euros.

Table 4.1 sumarizes the sample selection procedure:

Table 4.1 – Sample selection

	Firm-years observations
Datastream data base **All available non-financial listed firms for primary variables**	**9.877**
Less:	
Missing data after to remove negative book values equity (BVE_{it}) observations:	(179)
Missing data after compute changes for some primary variables ($\Delta REC_{it}, \Delta INV_{it}, \Delta PAY_{it}$):	(509)
Missing data after compute some secondary variables ($NI^{a}_{it}, ACC_{it}, DIFmbv_{it}$):	(58)
Missing data after to consider a minimum of 3 years consecutive observations:	(2197)
Missing data after outliers removed:	(4)
Size of the final sample	***6.930***

Notes:

The sample comprises 6.930 firm-year observations for the period 1990-2009, in relation to 2.340 firms. NI^{a}_{it} is abnormal earnings, defined as earnings minus the normal return on equity book value (BVE_{it} is the common equity, WS 03501), $NI^{a}_{it} = NI_{it} - r \times BVE_{it-1}$, where r is a discount rate, which is an intertemporal constant rate. The earnings variable is calculated as net income before extraordinary items/preferred dividends (NI_{it} , WS 01551). MVE_{it} is the market value equity (WS 08001). Dif_{MBV} is the market value added ($Dif_{MBV} = MVE_{it} - BV_{it}$), that means, the difference between the current market and book values of common equity. ACC_{it} is total accruals, defined as earnings (NI_{it} ,WS 01551) minus cash flows from operations

Table 4.1 – Sample selection

(CFO_{it}, WS 04201). TA_{it} is the total assets (WS 02999). REV_{it} is the net sales or revenues (WS 01001). DEP_{it} is the depreciation, depletion and amortization (WS 01151). ΔREC_{it} is the firm i's change in receivables between year $t-1$ and year t (receivables, WS 02051); ΔINV_{it} is the firm i's change in inventories between year $t-1$ and year t (inventories, WS 02101); ΔPAY_{it} is the firm i's change in payables between year $t-1$ and year t (accounts payable, WS 03040).

4.4.2. Descriptive statistics

Tables 4.2 and 4.3 report descriptive statistics to primary variables and input variables used in the estimating equations for all period 1990-2009.

Table 4.2 – Descriptive statistics for all firm-year observations

	Variable	Mean	Median	Standard deviation	Min.	Max.	Skewness	Kurtosis
Primary Variables (Absolute monetary values)	**Net income (** NI_{it} **)**	79,47	4,03	72,55	-32.085,00	22.710,00	0,82	500,32
	Market value of equity (MVE_{it} **)**	2.344,90	199,00	9.730,00	0,29	346.600,0	12,83	255,69
	Book value of equity (BVE_{it} **)**	691,80	51,99	4.596,30	0,001	236.827,8	23,34	830,95
	Abnormal earnings (NI^{a}_{it} **)**	36,32	1,37	754,53	-40.893,00	17.805,00	-19,48	1.091,0
	Total accruals (ACC_{it} **)**	-130,00	-4,79	879,58	-49.884,00	5.537,00	-22,83	843,05
	Change in inventory (ΔINV_{it} **)**	9,62	0,02	234,02	-7.736,00	12.350,00	12,47	865,17
	Change in receivables (ΔREC_{it} **)**	18,72	0,60	474,85	-26.848,00	31.909,00	15,32	1.799,20
	Change in payables (ΔPAY_{it} **)**	13,90	0,05	249,04	-11.197,00	10.787,00	7,31	601,41
		99,68	3,74	602,63	-13,95	26.440,00	16,59	443,68

Table 4.2 – Descriptive statistics for all firm-year observations

	Variable	Mean	Median	Standard deviation	Min.	Max.	Skewness	Kurtosis
	Depreciation and amortization (DEP_{it} **)**							
	Revenues (REV_{it} **)**	1.635,00	98,06	8.752,30	0,07	313.400,0	17,24	413,63
	Total Assets (TA_{it} **)**	2.163,20	120,04	10.420,00	0,00	279.730,0	11,54	178,81
Input Variables of the Models (Relative values)	$\frac{MVE_{it}}{TA_{it}}$	86,36%	62,67%	92,10%	0,63%	1348,6%	4,71	36,27
	$\frac{BVE_{it}}{TA_{it}}$	44,39%	42,19%	21,59%	0,00%	489,28%	0,74	8,96
	$\frac{ACC_{it}}{TA_{it}}$	- 4,84%	- 3,91%	12,95%	- 668,12%	275,31%	-19,75	842,61
	$\frac{NI_{it}^{a}}{TA_{it}}$	0,19%	1,43%	11,97%	- 165,76%	166,34%	-3,18	33,75
	$\frac{\lvert\Delta INV_{it}\rvert}{REV_{it}}$	6,64%	1,25%	44,89%	0,00%	2.287,5%	26,66	945,98
	$\frac{\lvert\Delta REC_{it}\rvert}{REV_{it}}$	12,83%	3,69%	55,26%	0,00%	1.505,0%	15,11	292,03
	$\frac{\lvert\Delta PAY_{it}\rvert}{REV_{it}}$	5,70%	1,71%	30,25%	0,00%	1.299,2%	21,06	563,62
	$\frac{\lvert\Delta DEP_{it}\rvert}{REV_{it}}$	8,30%	3,98%	28,38%	0,00%	912,50%	18,09	421,76

Notes: The variables were defined in the previous table, table 4.1.

In table 4.2, the descriptive statistics reveal that all primary variables presents means and median values with a significantly difference between them, which indicates the presence of outliers due to the fact that we are working with a very diverse sample of firms in terms of size. Outliers are data values that are dramatically different from patterns in the rest of the data. They may be due to measurement error, or they may represent significant features in the data. Identifying outliers, and deciding what to do with them, depends on an understanding of the data and its source. To provide insight into the relative size of each firm, the input variables of the model are the result of the divison between some primary variables and total assets or total revenues with the aim of removing the size effect of the different firms.

The descriptive statistics also reveal that in generally the input variables of the models ($\frac{MVE_{it}}{TA_{it}}$, $\frac{BVE_{it}}{TA_{it}}$, $\frac{NI^{a}_{it}}{TA_{it}}$, $\frac{ACC_{it}}{TA_{it}}$, $\frac{|\Delta INV_{it}|}{REV_{it}}$, $\frac{|\Delta REC_{it}|}{REV_{it}}$, $\frac{|\Delta PAY_{it}|}{REV_{it}}$, $\frac{|\Delta DEP_{it}|}{REV_{it}}$) present close mean and median values, what leads us to conclude that the distributions are symmetrical or lightly asymmetric, and that the arithmetic mean can be used to describe the center of the distribution.

In table 4.2, we also report the skewness and kurtosis measures of the variables. The study of skenness an kurtosis allows to see if the distribution is symmetric, which is a necessary conditions but not sufficient for the distribution to be normal. Then, we describe the analysis of skenness and kurtosis only for the input variables of the model.

According to the asymmetry, we conclude that the distribution of the $\frac{BVE_{it}}{TA_{it}}$ variable is slightly asymmetric because skenness value is close to zero. The distributions of the all others variables are skewed. The variables $\frac{|\Delta INV_{it}|}{REV_{it}}$, $\frac{|\Delta REC_{it}|}{REV_{it}}$, $\frac{|\Delta PAY_{it}|}{REV_{it}}$ and $\frac{|\Delta DEP_{it}|}{REV_{it}}$ are very asymmetric, since the asymmetry coefficients take values greater than zero. These variables are concentrated to the left with a long tail to the right. Finally, the distributions of the variables $\frac{MVE_{it}}{TA_{it}}$, $\frac{ACC_{it}}{TA_{it}}$ and $\frac{NI^{a}_{it}}{TA_{it}}$ are concentrated to the right with a long tail to the left due to negative skenness value. Therefore, there is not a standard distribution for all variables analyzed.

Relatively to the *Kurtosis* measure we can conclude that all variables present distributions peaked and leptokurtic – the distribution said to be leptokurstic because the coefficients of flatness or kurtosis have values greater than zero. According to Maroco (2003), a distribution is normal if the values of the coefficients described should be close to zero, that is, within an interval between]-0.5; 0.5[(see for example, Runyon *et al.*, 1996). When the absolute values of these coefficients are greater than 1, it can be assumed that the distribution of data is not the normal type, which is the case.

Acording to Davidson and Mackinnon (1993), if the error terms are severely leptokurtic (excess kurtosis), that is, if their distributions are very thick tails, ordinary least squares (OLS) may be highly inefficient relative to some other estimator that takes the leptokurtosis into account. Similarly, if the error terms are skewed, it will be possible to do better that least squares by using an estimator that recognizes the presence of the skewness. For example, in these cases the generalized least squares (GLS) is preferable to ordinary least squares (OLS) estimator, since GLS estimator is more efficient.

Finally, if we are dealing with a small, or finite, sample size, say data of less than 100 observations, the normality assumption assumes a critical role. It not only help us to derive the exact probability distributions of OLS estimators but also enables us to use the t, F, and χ^2 statistical tests for regression models. If the sample size is reasonably large, as is our case, we may be able to relax the normality assumption (Gujarati, 2008).

The descriptive statistics present in table 4.2 reveal that, on average, the market value of equity exceeds the book value of equity, indicating that equity book value alone is insufficient to explain equity market value. If we look to the mean, median, maximum and minimum values for book value of equity (input variable of the models), we observe that they are always smaller than market capitalization. Also the standard deviation of book value is smaller than for market capitalization. This is consistent with accounting conservatism.

In the next figure 1, we can observe the market value of equity and book value of equity trend. The figure 1 reveals that market value exceeds the book value equity.

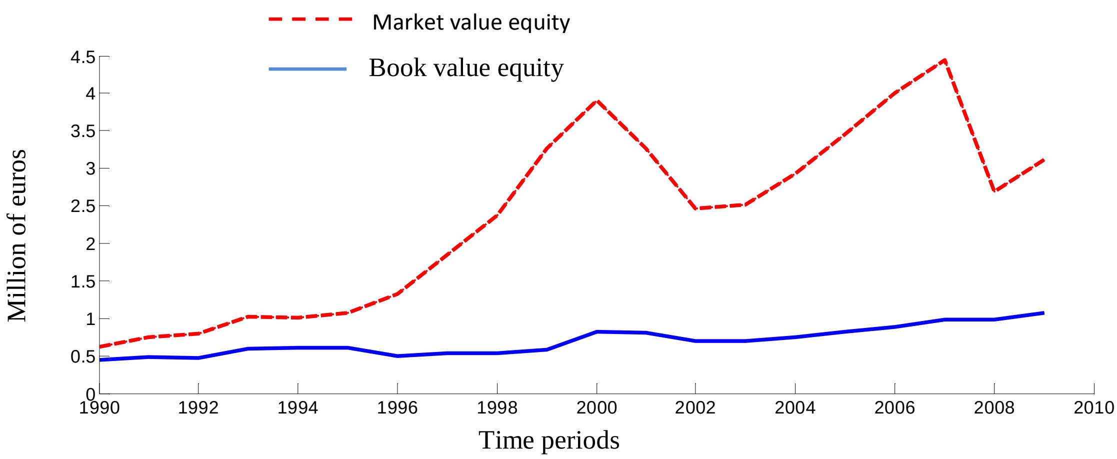


Figure 1: Market value equity and book value equity trend

Consistent with prior research (Sloan, 1996; Barth *et al.*, 1999, 2001 and 2005), the results report in table 4.2 also reveal that, on average, total accruals is negative. This is attributable to depreciation expense being included in accruals but capital expenditures being included in investing cash flows. In particular, mean depreciation and amortization expense, € 99.68 million, is more than five times greater than mean change in receivables, € 18.72 million, the next largest accrual component. To provide insight into the relative size of each accrual component, table 4.2 also includes distributional statistics for the absolute value of each component divided by total revenue. Findings indicate that all four accrual components comprise a nontrivial proportion of total revenues, with change in receivables being the largest component (mean = 12.83% of total revenues), and change in accounts payable being the smallest (mean = 5.70% of total revenues).

In the next table 4.3 we present the correlation matrix to the variables inputs in the regression. The variables correlations measures are the *Pearson* correlation coefficient (values that are above the diagonal) and *Spearman* correlation coefficient (values that are below the diagonal). Pearson correlation coefficient is a measure of linear association between quantitative variables and the Pearson correlation coefficient varies between -1 and 1. The closer Pearson correlation are of the extreme values, greater linear association is. According to Bryman and Cramer (1993), a correct lecture of correlations coefficients are: lower than 0,19 it is a weak correlation, 0.20 to 0.39 is lower, 0.40 e 0.69 it is a moderate correlation; 0.70 to 0.89 it is a higher correlation; and 0.90 to 1 it is a very higher correlation. *Spearman* correlation coefficient use observation order value instead of observed value. Thus, is not sensitive to asymmetric distributions and the presence of *outliers*.

Table 4.3 – Correlations, with Pearson (Spearman) correlations above (below) the diagonal

	$\frac{MVE_{it}}{TA_{it}}$	$\frac{BVE_{it}}{TA_{it}}$	$\frac{NI^{a}_{it}}{TA_{it}}$	$\frac{ACC_{it}}{TA_{it}}$	$\frac{\lvert\Delta INV_{it}\rvert}{REV_{it}}$	$\frac{\lvert\Delta REC_{it}\rvert}{REV_{it}}$	$\frac{\lvert\Delta PAY_{it}\rvert}{REV_{it}}$	$\frac{\lvert\Delta DEP_{it}\rvert}{REV_{it}}$
$\frac{MVE_{it}}{TA_{it}}$	1	0,1484** **(0,000)**	0,0862** **(0,000)**	0,0334** **(0,003)**	-0,041** **(0,000)**	0,0449** **(0,000)**	0,0457** **(0,000)**	0,0668** **(0,000)**
$\frac{BVE_{it}}{TA_{it}}$	0,1644** **(0,000)**	1	-0,128** **(0,000)**	0,0522** **(0,000)**	0,0607** **(0,000)**	0,0892** **(0,000)**	-0,0033** **(0,7639)**	0,1196** **(0,000)**
$\frac{NI^{a}_{it}}{TA_{it}}$	0,3391** **(0,000)**	-0,159** **(0,000)**	1	0,1238** **(0,000)**	-0,0809** **(0,000)**	-0,2330** **(0,000)**	-0,2111** **(0,000)**	-0,2620** **(0,000)**
	0,0166 **(0,1468)**	0,059** **(0,000)**	0,1064** **(0,000)**	1	0,0831** **(0,000)**	0,0658** **(0,000)**	-0,0265* **(0,0188)**	-0,2188** **(0,0000)**

Table 4.3 – Correlations, with Pearson (Spearman) correlations above (below) the diagonal

	$\frac{MVE_{it}}{TA_{it}}$	$\frac{BVE_{it}}{TA_{it}}$	$\frac{NI^{a}_{it}}{TA_{it}}$	$\frac{ACC_{it}}{TA_{it}}$	$\frac{\lvert\Delta INV_{it}\rvert}{REV_{it}}$	$\frac{\lvert\Delta REC_{it}\rvert}{REV_{it}}$	$\frac{\lvert\Delta PAY_{it}\rvert}{REV_{it}}$	$\frac{\lvert\Delta DEP_{it}\rvert}{REV_{it}}$
$\frac{ACC_{it}}{TA_{it}}$								
$\frac{\lvert\Delta INV_{it}\rvert}{REV_{it}}$	-0,0761** (0,000)	0,0216* (0,0508)	-0,006** (0,5922)	0,0431** (0,000)	1	0,1632** (0,000)	0,2267** (0,000)	-0,0570** (0,000)
$\frac{\lvert\Delta REC_{it}\rvert}{REV_{it}}$	0,0334** (0,0036)	0,0695** (0,000)	-0,142** (0,000)	0,0971** (0,000)	0,0621** (0,000)	1	0,3502** (0,000)	0,1329** (0,000)
$\frac{\lvert\Delta PAY_{it}\rvert}{REV_{it}}$	0,0614** (0,000)	-0,037** (0,000)	-0,085** (0,000)	-0,0604** (0,000)	0,2052** (0,000)	0,3024** (0,000)	1	0,1613** (0,000)
$\frac{\lvert\Delta DEP_{it}\rvert}{REV_{it}}$	0,1052** (0,000)	0,1493** (0,000)	-0,192** (0,000)	-0,2628** (0,000)	-0,0577** (0,000)	0,0687** (0,000)	0,1152** (0,000)	1

Notes: The variables were defined in the previous table, table 4.1.
** Correlation is statistic significance for level of 1%.
* Correlation is statistic significance for level of 5%.
P-values (coefficients significant) are in boldface below the correlations.

The matrix correlation can be used to verify the association level between variables. The results report in table 4.3 reveal that, in spite of most of the variables have a linear association (correlation) significant, for a 1% significance level, most of them are weakly correlated with each other.

Next, we present a brief statistical description about frequency of negative book value equity, distribution of firms in relation to years with negative book value equity and negative book value equity and firm size.

4.4.3. Book value equity – frequency of negative book value equity

The distribution of the negative book value equity is asymmetric. Thus, in the following table 4.4, we present the relative frequency of the negative book value equity.

In the sample, the negative book value equity represent 16,9% of all firm-years. There is an increase in the frequency of negative book value equity over time. From the 1990's to the beginning of the century XXI, there was an increase of about 7,1%.

The years 2003 and 2004 were the years that had, in relative terms, a higher percentage of negative book value equity in relation to the total observations (firm-years), 5,1% and 5,0% respectively. The year 1990 showed the lowest negative book value equity incidence.

Table 4.4 – Frequency of negative book value equity

Year	Total number of firms	Total firms with negative BE	% of firms with negative BVE
All years	2340	395	16,9
1990-1999	1745	128	7,3
2000-2009	2322	314	13,5
1990	749	11	1,5
1991	789	16	2,0
1992	830	21	2,5
1993	867	26	2,9
1994	898	19	2,1
1995	940	26	2,8
1996	1283	36	2,8
1997	1452	44	3,0
1998	1571	47	3,0
1999	1729	52	3,0
2000	1874	49	2,6
2001	1943	52	2,7
2002	2023	71	3,5
2003	2029	106	5,1
2004	2160	108	5,0
2005	2216	104	4,7
2006	2238	93	4,2
2007	2239	89	4,0
2008	2227	92	4,1
2009	2062	96	4,7

The variability in the frequency of the negative book value equity over time is partly explained by structural changes in the economy. Others explanations for this variability is due to firms mergers and firms acquisitions, change in accounting standards and principles, etc. Other possible explanations for this phenomenon should be explored in future research.

The following figure 2 shows the frequency of the negative book value equity for each year of the sample.

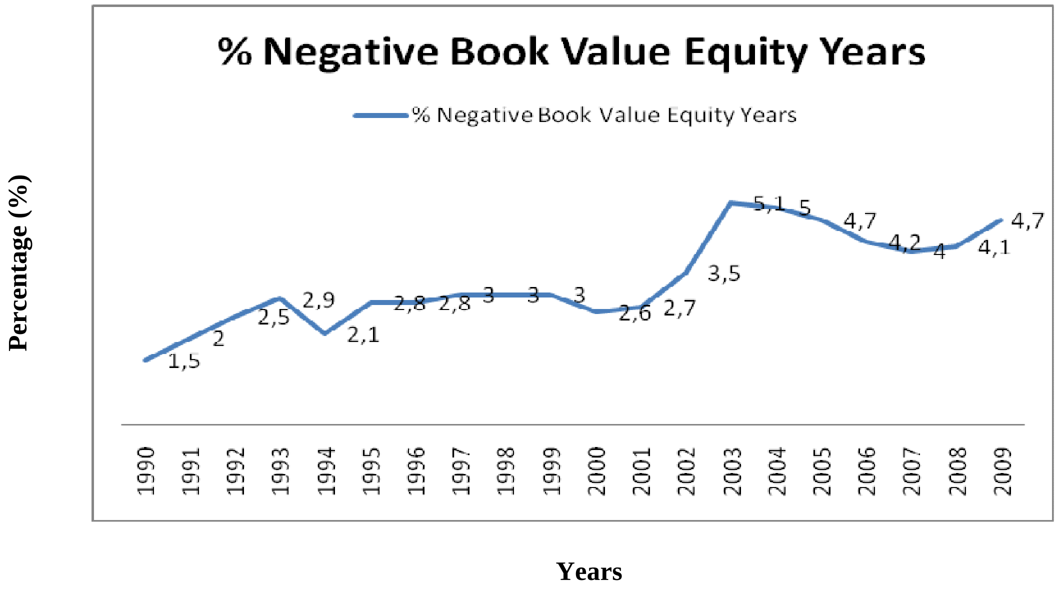


Figure 2: Percentage of years with negative book value equity

As shown in table 4.5, considering the firms with at least three years of data, 16,9 % of the firms reported the existence of negative book value during the period under review, 6,1 % of firms had at least one year of negative book value equity and the most of them (83,1%) always reported positive book value equity over time.

Table 4.5 – Distribution of firms in relation to years with negative book value equity

Number of years with negative book value equity	Number of firms	% of firms
All firms	2340	100,0
0	1945	83,1
1	143	6,1

Table 4.5 – Distribution of firms in relation to years with negative book value equity

Number of years with negative book value equity	Number of firms	% of firms
2	83	3,6
3	61	2,6
4	34	1,5
5	24	1,0
6	18	0,1
7	8	0,0
8	5	0,0
9	3	0,0
10	6	0,0
11	4	0,0
12	4	0,0
13	1	0,0
14	1	0,0
15	0	0,0
16	0	0,0
17	0	0,0
18	0	0,0
19	0	0,0
20	0	0,0

The existence of negative book value equity is strongly related to firm size. The following table 4.6 shows the probability of a negative book value equity for ten equal-sized portfolios of firm-years ordered by the market value of the firms' equity[33].

Table 4.6 – Negative book value equity and firm size

Portfolios	Number of firms	Number of firms with negative book value equity	% of firms with negative book value equity
All portfolios	2340	395	16,9

[33] Ten portfolios are formed each year based on the market value of the firms' equity at the end of the previous year.

Table 4.6 – Negative book value equity and firm size

Portfolios	Number of firms	Number of firms with negative book value equity	% of firms with negative book value equity
1 (smaller firms)	1227	106	8,6
2	1226	44	3,6
3	1227	26	2,1
4	1227	6	0,5
5	1227	12	1,0
6	1226	23	1,9
7	1227	19	1,6
8	1227	15	1,2
9	1226	26	2,1
10 (bigger firms)	1227	12	0,9

From the analysis of table 4.6, we find in general that the number of years with negative book value equity decreases as firm size increases, except for the passage of the portfolio 4 to portfolio 5, the portfolio 5 to portfolio 6 and the portfolio 8 to portfolio 9, where there is a slight increase in the number of years with negative book value equity, from 6 to 12, 12 to 23 and 15 to 26, respectively.

The increase is relatively small, it does not affect the conclusion that the existence of negative book value equity is strongly related to firm size, there is an inverse and monotonic relationship between the size and the probability of negative book value equity.

In the next section 4.5, we present the results from abnormal earnings equations, accruals autoregression and linear information models (LIM) estimations, that is, valuation equations with and without imposing linear information model.

4.5. Results

This section aims to display and analyze the main results obtained through the use of the various panel data methods and estimations. In appendix 6, we explain the various panel data methods.

The results were obtained and corroborated through the use of two different softwares of econometric analysis: *MATLAB – version R2009b (Matrix Laboratory)* and *GRETL – version MS Windows (Gnu Regression, Econometric and Time-series Library)*,

To assess the robustness of the results of any empirical work, tests to the existence of heteroscedasticity of random disturbance terms should be performed. In this sense, after obtaining the first estimation results, we have performed the White[34] test in order to detect the presence of heteroscedasticity in the error terms (not verification of the classical hypothesis, the homoscedasticity). The homoscedasticity means that the error term variance is constant. The presence of heteroscedasticity does not affect the centricity nor the consistency of the estimators, however, it implies the loss of statistical inference validity on these estimates, that is, the least squares estimators are unbiased and consistent but not efficient, they are not estimators with minimum variance.

An important assumption of the classical linear regression model is that the disturbances (error term) appearing in the population regression function are homoscedastic, that is, they all have the same variance. Heteroscedasticity can also arise as a result of the presence of outliers. Another source of heteroscedasticity is skewness in the distribution of one or more regressors included in the model.

Unfortunately, the usual ordinary least squares (OLS) method does not follow this strategy and therefore does not make use of the "information" contained in the unequal variability of the dependent variable, say, it assigns equal weight or importance to each observation. But a method of estimation, known as generalized least squares (GLS), takes such information into account explicitly and is therefore capable of producting estimators that are BLUE. In short, generalized least squares is ordinary least squares on the transformed variables that satisfy the standard least-

[34] In appendix 8, we present an explanation of the White test.

squares assumptions. The estimators thus obtained are known as generalized least squares estimators, and it is these estimators that are BLUE[35].

In generalized least squares we minimize a weighted sum of residual squares, but in ordinary least squares we minimize an unweighted (what amounts to the same thing). Since minimizes a weighted sum of residual squares, it is appropriately known as weighted least squares (WLS), and the estimators thus obtained and given are known as weighted least squares estimators. But weighted least squares is just a special case of the more general estimating technique, generalized least squares. In the context of heteroscedasticity, one can treat the two terms weighted least squares and generalized least squares interchangeably. The message is clear: in presence of heteroscedasticity, use generalized least squares. If its presence is detected, then one can take corrective action, such as using the weighted least-squares regression or some other technique.

The fundamental advantage of a panel data set over a cross section is that it will allow the researcher great flexibility in modeling differences in behavior across individuals. The heterogeneity, or individual effect.

All estimations that showed the presence of heteroscedasticity were corrected using heterogeneity adjusted model, provided in GRETL[36]. The model calculates a weighted residuals series. Thought this correction, it is computed an ordinary least squares estimation and kept the residuals terms. With this regression, the residuals squares became an explanatory variable in an auxiliary regression, and the other original explanatory variables remain added to residual squares. Thus, coefficients obtain in auxiliary regressions are used to form residual weight series in the final estimators. Consequently, ordinary least squares estimation can be done since there is a correction in the residual covariance matrix to consider heterogeneity. Thus and according to Gujarati (2008), the estimation is robust and called as generalized least squares.

[35] The BLUE estimators are provided by the method of weighted least squares, and the heteroscedastic error variances, σ_i^2, are known. In the presence of heteroscedasticity, the variance of OLS estimators are not provided by the usual OLS formulas. But if we persist in using the usual ordinary least squares (OLS) formulas, the t and F tests based on them can be highly misleading, resulting in erroneous conclusions.

[36] GRETL command Menu: Model/other linear models/heterogeneity adjusted.

All regressions models mentioned above were estimated in three particular cases: *pooled* regression, fixed effects model and random effects model. Next, we will present the best estimation results given the various realized tests[37], and we comment the results.

4.5.1. Results from abnormal earnings equations – Persistence and predictability coefficients

Table 4.7 presents regression summary statistics corresponding to the abnormal earnings equations [4.1a], [4.2a] and [4.3a], which measure the persistence and predictability coefficients.

Table 4.7 – Abnormal earnings equations – Persistence coefficients and predictability coefficients

Variable	Pred. Sign	Equation [4.1a] Coef. (t-stat.)	Equation [4.2a] Coef. (t-stat.)	Equation [4.3a] Coef. (t-stat.)
Observations		20.079	19.077	15.826
NI^{a}_{it-1}	+	**+ 0,1819***** (10,72)	**+ 0,3764***** (24,58)	**+ 0,2077***** (23,54)
ACC_{it-1}	-		**- 0,2512***** (-20,45)	
ΔREC_{it-1}	+/-			**- 0,0086***** (-2,81)
ΔINV_{it-1}	+/-			**+ 0,0146***** (4,81)
ΔPAY_{it-1}	+/-			**+ 0,0059** (1,09)
DEP_{it-1}	+/-			**- 0,0376***** (-3,30)
v_{it}	+	**+ 0,0556***** (3,29)	**+ 0,0245** (1,59)	**+ 0,0208**** (2,32)
$\bar{R}^2$		28,89%	36,26%	30,61%
White test		Chi2(5) = 1227,55 ***p-value*** = 0,0000	Chi2(9) = 2187,49 ***p-value*** = 0,0000	Chi2(5) = 999,30 ***p-value*** = 0,0000
Test F		F(1741, 18335) = 2,17 ***p-value*** = 0,0000	F(1737, 18147) = 3,81 ***p-value*** = 0,0000	F(1639, 14180) = 2,25 ***p-value*** = 0,0000

[37] We perform *F*, *Breusch-Pagan* and *Hausman* tests in order to accept or reject the null hypothesis associated, respectively, with: (1) only one intercept identify in all individuals in *cross-section*; (2) a null variance, and (3) the GLS estimators are consistent.

Table 4.7 – Abnormal earnings equations – Persistence coefficients and predictability coefficients

Breusch-Pagan	Chi2(1) = 21,78 ***p-value*** = 0,0000	Chi2(1) = 725,04 ***p-value*** = 0,0000	Chi2(1) = 36,14 ***p-value*** = 0,0000
Test Hausman	Chi2(2) = 1961,18 ***p-value*** = 0,0000	Chi2(2) = 3280,47 ***p-value*** = 0,0000	Chi2(6) = 1927,19 ***p-value*** = 0,0000
Estimation method	Fixed Effects	Fixed Effects	Fixed Effects

To measure earnings persistence we use three different abnormal earnings equations, which integrates our different linear information models, respectively:

Equation [4.1a]: $NI_{it}^{a} = \omega_{10} + \omega_{11} NI_{it-1}^{a} + \omega_{12} v_{it} + \varepsilon_{1it}$

Equation [4.2a]: $NI_{it}^{a} = \omega_{10} + \omega_{11} NI_{it-1}^{a} + \omega_{12} ACC_{it-1} + \omega_{13} v_{it} + \varepsilon_{1it}$

Equation [4.3a]: $NI_{it}^{a} = \omega_{10} + \omega_{11} NI_{it-1}^{a} + \omega_{12} \Delta REC_{it-1} + \omega_{13} \Delta INV_{it-1} + \omega_{14} \Delta PAY_{it-1} + \omega_{15} DEP_{it-1} + \omega_{16} v_{it} + \varepsilon_{1it}$

Notes:
NI_{it}^{a} is abnormal earnings, defined as earnings minus the normal return on equity book value (BVE_{it} is the common equity, WS 03501), $NI_{it}^{a} = NI_{it} - r \times BVE_{it-1}$, where r is a discount rate, which is an intertemporal constant rate. The earnings variable is calculated as net income before extraordinary items/preferred dividends (NI_{it} , WS 01551); v_{it} is the *other information* and it is defined as the difference between abnormal earnings $\left(NI_{it}^{a}\right)$ and the fitted value of abnormal earnings equations does not include v_{it} , that is, $NI_{it}^{a} - \overline{NI_{it}^{a}}$, where $\overline{NI_{it}^{a}}$ is the fitted value of NI_{it}^{a} based on a version of abnormal earnings equation that does not include v_{it} ; ACC_{it} is total accruals, defined as earnings (NI_{it} ,WS 01551) minus cash flows from operations (CFO_{it} , WS 04201); ΔREC_{it} is the firm i 's change in receivables between year $t-1$ and year t (receivables, WS 02051); ΔINV_{it} is the firm i 's change in inventories between year $t-1$ and year t (inventories, WS 02101); ΔPAY_{it} is the firm i 's change in payables between year $t-1$ and year t (accounts payable, WS 03040); DEP_{it} is the depreciation, depletion and amortization (WS 01151); Some variables, as the abnormal earnings and total accruals, are divided by total assets, TA_{it} is the total assets (WS 02999). Each accrual components, receivables, inventories, accounts payable and depreciation, depletion and amortization, are divided by total revenues, REV_{it} is the net sales or revenues (WS 01001).

*** statistic significance for level of 1%.
** statistic significance for level of 5%.
* statistic significance for level of 10%.

In order to ascertain whether the type of firm affect the autonomous part of the models, we tested if the *pooled* model is appropriate (null hypothesis) against the alternative hypothesis of fixed effects model. In other words, we test the homogeneity in the constant of the model against its hetegeneity, by using the *F* test. The *F* test present a value of 2.17 for equation [4.1a], 3.81 for equation [4.2a] and 2.25 for equation [4.3a], both values with a *p-value* < 0.05, indicating the rejection of the *pooled* model hypothesis is appropriate.

The Breusch-Pagan test confirms the rejection of the *pooled* model hypothesis is appropriate, validating the alternative hypothesis of the existence of random effects. The values of the LM-Breusch and Pagan are 21.78 for equation [4.1a], 725.04 for equation [4.2a] and 36.14 for equation [4.3a], both values with a *p-value* < 0.05.

According to the Hausman test, the estimates of the generalized least squares (GLS) model with random effects are not consistent, suggesting that the fixed effects model is more appropriate (H = 1961.18 for equation [4.1a], H = 3280.47 for equation [4.2a] and H = 1927.19 for equation [4.3a]), we reject the null hypothesis with a *p-value* = 0.000 for both equations.

So, performing *F*, *Breusch-Pagan* and *Hausman* tests we conclude that fixed effects model improves our results and it is econometrically more appropriate.

From results show in table 4.7, we emphasized the heteroscedasticity verified, performing White test. We reject the null hypothesis with a *p-value* = 0.000 for both equations, consequently we correct the estimations using the heterogeneity adjusted model, namely, using a fixed effects model we take into account the individual heterogeneity.

Results from the multicollinearity test show Variance Inflaction Factors[38] (VIF) values varies from 1.179 to 5.067, which validate the regression, since it shows that there is no multicollinearity, once that all values are less than 10.

The findings relating to abnormal earnings equations in table 4.7 are consistent with prior research (Barth *et al.*, 1999 and 2005; Dechow *et al.*, 1999; Hand and Landsman, 1999). In particular, the persistence coefficients of the contemporaneous abnormal earnings on future abnormal earnings, ω_{11} is always significantly positive for all models.

Moreover, consistent with predictions based on Sloan (1996), the ω_{12} coefficient of the equation [4.2a], the predictability coefficients of total accruals on abnormal earnings equation is significantly negative, suggesting that the lower the proportion of current earnings attributable to accruals, the higher future abnormal earnings will be.

[38] In appendix 7, we present the variance inflaction factors.

In addition, and in line with prior research (Barth *et al.*, 1999 and 2005; Dechow *et al.*, 1999), we performed a *t*-test[39] for equation [4.2a]. The test hypotheses were:

$H_0 : \omega_{11} + \omega_{12} = 0$ (forecasting irrelevance)

$H_A : \omega_{11} + \omega_{12} \neq 0$ (forecasting relevance)

The result of the *t*-test was *t* (19073) = 32.80 with *p-value* = 0.000, so, we reject the null hypothesis that $\omega_{11} + \omega_{12} = 0$. This means, rejecting the forecasting irrelevance of accruals.

We can also observe that the predictability coefficients ($\omega_{12}, \omega_{13}, \omega_{14}, \omega_{15}$) of major components of accruals on abnormal earnings equation show substantial differences in those values across the components. The coefficient estimates (*t*-statistics) are – 0.0086, 0.0146, 0.0059 and -0.0376 (-2.81, 4.81, 1.09 and -3.30). The coefficients of change in receivables and depreciation (ω_{12} and ω_{15}) are negative and statistical significant, what corroborates the previous conclusions that the lower proportion of current earnings attributable to accruals or major components of accruals, the higher future abnormal earnings. The coefficients of change in inventory and payables (ω_{13} and ω_{14}) are positive, however, only the incremental coefficient of change in inventory is statistical significant. This result corroborate the previous predictions that increases in inventory are negatively associated with future earnings, since that increases in inventory can reflect increases in factor input prices, which results in higher current expenses and lower current earnings.

The coefficient on other information, ω_{12} from equation [4.1a], ω_{13} from equation [4.2a] and ω_{16} from equation [4.3a], is positive and statistical significant for two of the equations (except equation

[39] *T*-test is any statistical hypothesis test in which the test statistic follows a Student's *t* distribution if the null hypothesis is supported. It is most commonly applied when the test statistic would follow a normal distribution if the value of a scaling term in the test statistic were known. When the scaling term is unknown and is replaced by an estimate based on the data the test statistic (under certain conditions) follows a Student's *t* distribution. If z is an $N[0,1]$ variable and x is $\chi^2[n]$ and is independent of z, then the ratio $t[n] = \frac{z}{\sqrt{x/n}}$ has the *t distribution* with n degrees of freedom.

[4.2a]), indicating that other information could be significant in determining future abnormal earnings. The coefficient estimates (*t*-statistics) are respectively 0.0556, 0.0245 and 0.0208 (3.29, 1.59 and 2.32).

4.5.2. Results from accruals autoregression

Table 4.8 presents regression summary statistics corresponding to the earnings component autoregression equation [4.2b]. The accruals autoregressions reveal that γ_{22} is less than 1.00 indicating stationary autoregressive processes for accruals.

Table 4.8 – Accruals autoregression

Variable	**Pred. Sign**	**Equation [4.2b]** Coef. (t-stat.)
Observations		23.592
ACC_{it-1} (γ_{22})	+	**+ 0,051***** (7,53)
$\bar{R}^2$		7,87%
White test		Chi2(2) = 114,71 **p-value** = 0,0000
Test F		F(1773, 21817) = 1,71 **p-value** = 0,0000
Breusch-Pagan		Chi2(1) = 235,96 **p-value** = 0,0000
Test Hausman		Chi2(1) = 2518,05 **p-value** = 0,0000
Estimation method		Fixed Effects

To measure accruals autoregression, we use the follow equation, which integrates our linear information model 2 (LIM2):

Equation [4.2b]: $ACC_{it} = \gamma_{20} + \gamma_{22} ACC_{it-1} + \varepsilon_{2it}$

Note:
The earnings variable is calculated as net income before extraordinary items/preferred dividends (NI_{it} , WS 01551); ACC_{it} is total accruals, defined as earnings (NI_{it} ,WS 01551) minus cash flows from operations (CFO_{it} , WS 04201).

*** statistic significance for level of 1%.
** statistic significance for level of 5%.
* statistic significance for level of 10%.

Performing *F, Breusch-Pagan* and *Hausman* tests we conclude that fixed effects model improves our results and from results show in table 4.8. We emphasized the heteroscedasticity verified. Performing White test, we reject the null hypothesis with a *p-value* = 0.000 for, consequently we correct the estimations using heterogeneity adjusted model, namely, using a fixed effects model we take into account the individual heterogeneity.

The equation [4.2b] describes the autocorrelation, or persistence, of total accruals. The persistence coefficient of the contemporaneous total accruals variable on future total accruals, γ_{22}, is significantly positive. The coefficient (*t*-statistics) estimates, γ_{22}, is 0.051 (7.53). The higher γ_{22} the more persistent the component. Transitory earnings is characterized as a process in which γ_{22} = 0. In our sample the coefficient estimates is close to zero, so, we can conclude that total accruals are practically one transitory earnings component.

4.5.3. Results from prediction equations for each accrual component

Table 4.9 presents regression summary statistics corresponding to the prediction equations for each accruals component. Although each accruals component should aid in predicting future abnormal earnings, the sign of the relation between each component and future abnormal earnings is not predictable except for depletion, depreciation and amortization expense (DEP_{it}), as explained in the above section 4.3 about research design. The relations differ across the components, thus, linear information model 3 (LIM3) permits each accruals component to have a different forecasting relation with future abnormal earnings.

Table 4.9 – Forecasting equations for each accrual component

Variable	Pred. Sign	Equation [4.3b] Coef. (t-stat.)	Equation [4.3c] Coef. (t-stat.)	Equation [4.3d] Coef. (t-stat.)	Equation [4.3e] Coef. (t-stat.)
Observ.		15.909	24.067	24.240	28.919
NI^{a}_{it-1}	+				
ACC_{it-1}	-				
ΔREC_{it-1}	+/-	**- 0,0102** (-0,90)	**- 0,0334*** ** (-4,66)		
ΔINV_{it-1}	+/-	**- 0,0590*** ** (-5,86)	**- 0,0056** (-0,59)	**+ 0,0211*** ** (3,66)	
ΔPAY_{it-1}	+/-		**+ 0,0784*** ** (6,69)	**- 0,0313*** ** (-4,99)	
DEP_{it-1}	+	**+ 0,2199*** ** (6,36)	**+ 0,0832*** ** (5,99)		**+ 0,2264*** ** (44,03)
v_{it}	+	**+ 0,003** (0,01)			
$\bar{R}^2$		21,52%	16,89%	26,72%	39,87%
White test		Chi2(14) = 227,36 ***p-value*** = 0,0000	Chi2(14) = 135,91 ***p-value*** = 0,0000	Chi2(5) = 399,82 ***p-value*** = 0,0000	Chi2(2) = 2610,89 ***p-value*** = 0,0000
Test F		F(1644, 14260) = 2,84 ***p-value*** = 0,0000	F(2196, 21866) = 2,66 ***p-value*** = 0,0000	F(2197, 22040) = 3,99 ***p-value*** = 0,0000	F(2298, 26619) = 4,00 ***p-value*** = 0,0000
Breuch-Pagan		Chi2(1) = 54,87 ***p-value*** = 0,0000	Chi2(1) = 170,59 ***p-value*** = 0,0000	Chi2(1) = 237,93 ***p-value*** = 0,0000	Chi2(1) = 386,04 ***p-value*** = 0,0000
Test Hausman		Chi2(2) = 1469,94 ***p-value*** = 0,0000	Chi2(4) = 1307,7 ***p-value*** = 0,0000	Chi2(2) = 6321,02 ***p-value*** = 0,0000	Chi2(1) = 2604,91 ***p-value*** = 0,0000
Estimation method		Fixed Effects	Fixed Effects	Fixed Effects	Fixed Effects

For linear information model 3 (LIM3), equations [4.3b] through [4.3e] specify a prediction equation for each component:

Equation [4.3b]: $\Delta REC_{it} = \omega_{20} + \omega_{22}\Delta REC_{it-1} + \omega_{23}\Delta INV_{it-1} + \omega_{25}DEP_{it-1} + \omega_{26}v_{it} + \varepsilon_{2it}$

Equation [4.3c]: $\Delta INV_{it} = \omega_{30} + \omega_{32}\Delta REC_{it-1} + \omega_{33}\Delta INV_{it-1} + \omega_{34}\Delta PAY_{it-1} + \omega_{35}DEP_{it-1} + \varepsilon_{3it}$

Equation [4.3d]: $\Delta PAY_{it} = \omega_{40} + \omega_{43}\Delta INV_{it-1} + \omega_{44}\Delta PAY_{it-1} + \varepsilon_{4it}$

Equation [4.3e]: $DEP_{it} = \omega_{50} + \omega_{55}DEP_{it-1} + \varepsilon_{5it}$

Notes:
The variables were defines in the previous table 4.7.
*** statistic significance for level of 1%.
** statistic significance for level of 5%.
* statistic significance for level of 10%.

The results of *F* test present a *p-value* < 0.05, indicating that the *pooled* model hypothesis is not appropriate, the *Breusch-Pagan* test confirms the rejection of the *pooled* model hypothesis is appropriate and *Hausman* test suggests that fixed effects model is more appropriate.

With the findings of White test, we emphasized the heteroscedasticity, consequently we correct the estimations using heterogeneity adjusted model, namely, using a fixed effects model we take into account the individual heterogeneity.

In equation [4.3b], the coefficients (*t*-statistics) estimates of lagged value for change in receivables and change in inventories, ΔREC_{it-1} and ΔINV_{it-1}, are negative -0.0102 and -0.0590 (-0.90 and -5.86), however the coefficient estimate of change in inventories is the only statistical significant.

The results of prediction equation for change in inventories, equation [4.3c], present negative coefficients estimates for lagged value for inventories and change in receivables, however the only statistical significant coefficient estimate is the change in receivable. The coefficients (*t*-statistics) estimates of lagged value for inventories and change in receivables, ΔREC_{it-1} and ΔINV_{it-1}, are respectively -0.0334 and -0.0056 (-4.66 and -0.59).

So, attending to the findings of prediction equations for change in receivables and for change in inventories, we conclude for our sample that change in inventories is negatively related to change in receivables and the equivalent is also true, that is, change in receivables is negatively related to change in inventories.

The coefficient (*t*-statistics) estimate of change in payables, ΔPAY_{it-1}, in prediction equation for change in inventories, equation [4.3c], is positive and statistical significant, it is 0.0784 (6.69), which means that change in payables predict future change in inventory and these variables are positively related once those payables are used to purchase inventory.

In equation [4.3d], the coefficients (*t*-statistics) estimates of lagged value for payables and change in inventories, ΔPAY_{it-1} and ΔINV_{it-1}, are statistically significant, one is negative and the other is positive, their values are respectively -0.0313 and 0.0211 (-4.99 and 3.66). We can conclude that change in inventories also predict future change in payables and these variables are positively related, increases in payables can reflect increases in inventory attributable to purchases.

Finally, in relation to the last accrual component of earnings, depletion, depreciation and amortization expense (DEP_{it}), we can observe that the coefficients (*t*-statistics) estimates ω_{25}, ω_{35}

and ω_{55}, for prediction equations [4.3b], [4.3c] and [4.3e], are positive and statistical significant. They are respectively 0.2199, 0.0832 and 0.2264 (6.36, 5.99 and 44.03), what corroborates the previous expectations that depletion, depreciation and amortization expense (DEP_{it}) is positively associated with future sales because management increases purchases of noncurrent assets in anticipation of increased production, and increases in noncurrent assets result in higher depreciation.

4.5.4. Results from LIM estimations – Valuation equations (without and with LIM)

Table 4.10 presents regression summary statistics for the market value added equations for the three linear information models (LIMs).

Table 4.10 – Regression statistics for period 1990-2009

		Without LIM Structure			With LIM Structure		
Variable	**Pred.Sign**	**LIM 1** Coef. (t-stat.)	**LIM 2** Coef. (t-stat.)	**LIM 3** Coef. (t-stat.)	**LIM 1** Coef. (t-stat.)	**LIM 2** Coef. (t-stat.)	**LIM 3** Coef. (t-stat.)
Observ.		10.358	10.327	9.883	10.358	10.327	9.883
NI^a_{it}	+	**+ 1,2615***** (16,10)	**+ 2,0674***** (20,49)	**+ 1,3818***** (16,98)	**+ 0,443***** (15,82)	**+ 0,647***** (24,02)	**+ 0,6329***** (16,11)
ACC_{it}	-		**- 1,4925***** (-12,15)			**- 0,317***** (-12,67)	
ΔREC_{it}	+/-			**- 0,0166** (-0,45)			**- 0,0093**** (-2,16)
ΔINV_{it}	+/-			**+ 0,0355** (0,96)			**+ 0,0074** (1,48)
ΔPAY_{it}	+/-			**+ 0,1707**** (2,01)			**+ 0,0107** (1,48)
DEP_{it}	+/-			**- 0,2488**** (-2,45)			**- 0,0389**** (-2,53)
v_{it}	+	**+ 0,5699***** (7,05)	**+ 0,3934***** (4,75)	**+ 0,5967***** (7,02)	**+ 0,873***** (8,08)	**+ 0,768***** (6,96)	**+ 0,7876***** (9,83)
$\bar{R}^2$		48,3%	49,4%	48,4%	3,11%	3,60%	4,55%
White test		Chi2(2) = 832,40 ***p-value*** = 0,0000	Chi2(9) = 1452,74 ***p-value*** = 0,0000	Chi2(2) = 898,91 ***p-value*** = 0,0000			
Test F		F(614, 9741) = 14,63 ***p-value*** = 0,0000	F(1773, 2182) = 1,71 ***p-value*** = 0,0000	F(609, 9267) = 13,93 ***p-value*** = 0,0000			
Breusch-Pagan		Chi2(1) = 15231,1 ***p-value*** = 0,0000	Chi2(1) = 253,96 ***p-value*** = 0,0000	Chi2(1) = 14185,6 ***p-value*** = 0,0000			
Test Hausman		Chi2(1) = 52,0852 ***p-value*** = 0,0000	Chi2(1) = 2518,05 ***p-value*** = 0,0000	Chi2(6) = 52,2554 ***p-value*** = 0,0000			
Estimation method		Fixed Effects	Fixed Effects	Fixed Effects			
Wald test					Test stat.>Critical Value **1334,98 > 3,8415**	Test stat.>Critical Value **5990,56 > 5,9915**	Test stat.>Critical Value **1105,73 > 11,071**

We use three different valuation equations, this is, three linear information models (LIM1, LIM2 and LIM3):

Table 4.10 – Regression statistics for period 1990-2009

Equation [4.1b]: $\underbrace{\left(MVE_{it} - BVE_{it}\right)}_{Dif_{MBV}} = \beta_0 + \beta_1 NI_{it}^a + \beta_2 v_{it} + \mu_{it}$

Equation [4.2c]: $\underbrace{\left(MVE_{it} - BVE_{it}\right)}_{Dif_{MBV}} = \beta_0 + \beta_1 NI_{it}^a + \beta_2 ACC_{it} + \beta_3 v_{it} + \mu_{it}$

Equation [4.3f]: $\underbrace{\left(MVE_{it} - BVE_{it}\right)}_{Dif_{MBV}} = \beta_0 + \beta_1 NI_{it}^a + \beta_2 \Delta REC_{it} + \beta_3 \Delta INV_{it} + \beta_4 \Delta PAY_{it} + \beta_5 DEP_{it} + \beta_6 v_{it} + \mu_{it}$

Notes:

NI_{it}^a is abnormal earnings, defined as earnings minus the normal return on equity book value (BVE_{it} is the common equity, WS 03501), $NI_{it}^a = NI_{it} - r \times BVE_{it-1}$, where r is a discount rate, which is an intertemporal constant rate. The earnings variable is calculated as net income before extraordinary items/preferred dividends (NI_{it} , WS 01551); ACC_{it} is total accruals, defined as earnings (NI_{it} ,WS 01551) minus cash flows from operations (CFO_{it} , WS 04201); ΔREC_{it} is the firm i 's change in receivables between year $t-1$ and year t (receivables, WS 02051); ΔINV_{it} is the firm i 's change in inventories between year $t-1$ and year t (inventories, WS 02101); ΔPAY_{it} is the firm i 's change in payables between year $t-1$ and year t (accounts payable, WS 03040); DEP_{it} is the depreciation, depletion and amortization (WS 01151); Some variables, as the abnormal earnings and total accruals, are divided by total assets, TA_{it} is the total assets (WS 02999). Each accrual components, receivables, inventories, accounts payable and depreciation, depletion and amortization, are divided by total revenues, REV_{it} is the net sales or revenues (WS 01001).

*** statistic significance for level of 1%.
** statistic significance for level of 5%.
* statistic significance for level of 10%.

We present these statistics to provide descriptive evidence on the magnitudes and signs of the valuation parameter estimates and the effects on the estimates of imposing the LIM structure, and to facilitate comparison with prior research.

The *F* test present a value of 14.63 for equation [4.1b], 1.71 for equation [4.2c] and 13.93 for equation [4.3f], both values with a *p-value* < 0,05, indicating the rejection of the *pooled* model hypothesis is appropriate.

The Breusch-Pagan test confirms the rejection of the *pooled* model hypothesis is appropriate, validating the alternative hypothesis of the existence of random effects. The values of the LM-Breusch and Pagan are 15231.1 for equation [4.1b], 253.96 for equation [4.2c] and 14185.6 for equation [4.3f], both values with a *p-value* < 0,05.

The findings of Hausman test reveal that random effects model is not consistent, suggesting that the fixed effects model is more appropriate (H = 52.09 for equation [4.1b], H = 2518.05 for equation [4.2c] and H=52.26 for equation [4.3f], we reject the null hypothesis with a *p-value* = 0,000 for both equations.

So, performing *F*, *Breusch-Pagan* and *Hausman* tests we conclude that fixed effects model improves our results and it is more econometrically appropriate.

Performing White test we emphasized the heteroscedasticity, rejecting the null hypothesis with a *p-value* = 0.000 for both equations.

Results from the multicollinearity test show Variance Inflaction Factors (VIF), show that there is no multicollinearity, once that all values are less than 10.

The findings relating to linear information model 3 (LIM3) in table 4.10 are consistent with prior research (Barth *et al.*, 1999 and 2005; Dechow *et al.*, 1999). In particular, the valuation coefficients on abnormal earnings, β_1, is significantly positive in all models, both with and without imposing the linear information model (LIM) structure. For example, without imposing the linear information model (LIM) structure, the coefficient estimates (*t*-statistics) for all equations are respectively 1.26, 2.07 and 1.38 (16.10, 20.49 and 16.98).

The incremental valuation coefficient of total accruals, β_2, is significantly negative when the linear information model (LIM) structure is not (is) imposed. The fact that the coefficient of total accruals differs from that of other components of abnormal earnings suggests that disaggregating earnings into cash flow and total accruals can enhance market value added prediction.

Findings in linear information model 3 (LIM3) which permits separate coefficients for the four accrual components indicate substantial differences in coefficients across the components.

Regarding cross component differences, results from the estimation without imposing the linear information model (LIM) structure indicate that the incremental coefficients of change in inventories and change in payables (β_3 and β_4) are positive, and the incremental coefficients of change in receivables and depletion, depreciation and amortization expense (β_2 and β_5) are negative. However, the incremental coefficient of change in receivables and change in inventories are not significantly different from zero. The coefficient estimates (*t*-statistics) for $\beta_2, \beta_3, \beta_4$ and β_5 are -0.0166, 0.0355, 0.1707 and -0.2488 (-0.45, 0.96, 2.01 and -2.45).

Results from estimation imposing the linear information model (LIM) structure indicate that the incremental coefficients for the four accrual components maintain the signs of the coefficients in relation to the results from estimation without imposing linear information model (LIM), but its magnitude varies. The coefficient estimates (*t*-statistics) with imposing linear information model (LIM) for $\beta_2, \beta_3, \beta_4$ and β_5 are -0.0093, 0.0074, 0.0107 and -0.0389 (-2.16, 1.48, 1.48 and -2.53).

In addition, and relating to our third research hypothesis, we can observe that the valuation coefficient of net income differs from that of total accruals, and the valuation coefficients of the major accruals components differ significantly from each other. These findings suggest that disaggregating earnings into cash flow and total accruals, and total accruals into its four major components result in different predictive ability of accounting numbers and the composite measure of earnings quality (EQ) towards market value added

The valuation coefficient, of other information, v_{it}, is always significantly positive in the three linear information model (LIM), equation [4.1b],equation [4.2c] and equation [4.3f], when linear information model (LIM) structure is or is not imposed, which indicates that other information could be significant in determining current maket value added.

4.5.5. Estimation of restricted system of equations – Wald test

To address our first and second hypotheses, whether imposing linear information model (LIM) structure is important to draw inferences from valuation equations based on residual income models and whether imposing linear information structure, contemporaneous market value added provide a composite measure of earnings quality (EQ) that simultaneously captures the persistence, the predictability and the informativeness of earnings, we use a parametric statistical test called Wald Test. Whenever a relationship within or between data items can be expressed as a statistical model with parameters to be estimated from a sample, the Wald test can be used to test the true value of the parameter based on the sample estimate.

The Wald test is a parametric statistical test named after Abraham Wald with a great variety of uses. Whenever a relationship within or between data items can be expressed as a statistical model with parameters to be estimated from a sample, the Wald test can be used to test the true value of the parameter based on the sample estimate.

The Wald test compares specifications of nested models by assessing the significance of restrictions to an extended model with unrestricted parameters. The test requires:

– A restriction function on the parameters in the unrestricted model, evaluated at the unrestricted parameter estimates (r). Restriction function $r(\theta)$ specifying restrictions of the form $r(\theta)=0$ on parameters θ in the unrestricted models to be tested, evaluated at the unrestricted parameter estimates. The number of restrictions is the degree-of-freedom parameter for a test, and must be less than the number of parameters in the unrestricted model.

– The Jacobian of restriction function, evaluated at the unrestricted parameter estimates (R).

– A covariance estimators for the unrestricted model parameters, evaluated at the unrestricted parameter estimates $(EstCov)$.

The test statistics is:

$$stat = r'*inv\left(R*EstCov*R'\right)*r$$

The test hypotheses are:

H_0 : *Restricted model (With LIM)*

H_A : *Unrestricted model (Without LIM)*

When the test statistic exceeds a critical value in its asymptotic distribution, Wald test rejects the null hypothesis (H_0), restricted model in favor of the alternative, unrestricted model. The asymptotic distribution is chi-square, with degree-of-freedom parameter equal to the number of restrictions. The nominal significance level of the test determines the critical value, the default value of significance level is 0.05[40].

Considering the results of the Wald test report in the above table 4.10, the test statistic exceeds the critical value in all linear information models (LIM), equation [4.1b], equation [4.2c] and equation [4.3f], Wald test rejects the null hypothesis (H_0) consequently the restricted model is rejected in favor of the unrestricted model.

These findings suggest that research designs based on residual models need not impose the model structure because doing so neither increases nor decreases prediction errors. Thus, these findings supports the efficacy of drawing inferences from valuation equations based on residual income models that do not impose the structure implied by the model.

Financial theory considers that the linear model information (LIM) structure is only possible to impose in a scenario with a decreasing trend of net income/earnings because there is a strong presumption in economics that profitability is mean reverting. Given the competition effect, it is expected that the abnormal earnings follow a mean reverting process, that is, it is expected that abnormal earnings quickly revert for the sector/industry mean. Thus, in the medium and long term

[40] In our work, we use the MATLAB function which performs the Wald test at a default 5% significance level. Again, we are very grateful to Professor António Alberto Santos at FEUC for his valuable and powerful help in adapting the Wald test MATLAB function to our objective of study: whether imposing Linear Information Model (LIM) structure (restricted model) is important to draw inferences from valuation equations based on residual income models and whether imposing linear information structure, contemporaneous market value added provide a composite measure of earnings quality (EQ) that simultaneously captures the persistence, the predictability and the *informativeness* of earnings.

period the book value of the common equity constitutes an unbiased estimator of the firm market value of equity, this phenomenon is known as unbiased accounting.

Stigler (1963: 54) states that “there is no more important proposition in economic theory that, under competition, the rate of return on investment tends toward equality in all industries. Entrepreneurs will seek to leave relatively unprofitable industries and enter relatively profitable industries”. These standard economic arguments imply that, in a competitive environment, profitability is mean reverting within as well as across industries. Mean reversion in profitability implies that changes in profitability and earnings are to some extent predictable.

Fama and French (2000) consider that the mean reversion of profitability is highly nonlinear. Mean reversion is faster when profitability is below its mean and when it is far from its mean in either direction. The authors also consider that there is also predictable variation in earnings. Much of it traces to the mean reversion of profitability and an important practical implication of this result is that forecasts of earnings should exploit the mean reversion in profitability.

In the figure below, figure 3, we report an average of net income before extraordinary items/preferred dividends for different firms considered in our sample and we can see that in the most of the sample period, 1990-2009, there is a growing trend of net income before extraordinary items/preferred dividends, except for the period 2000-2004. Thus, this can be a possible reason why restricted model is rejected in favor of the unrestricted model.

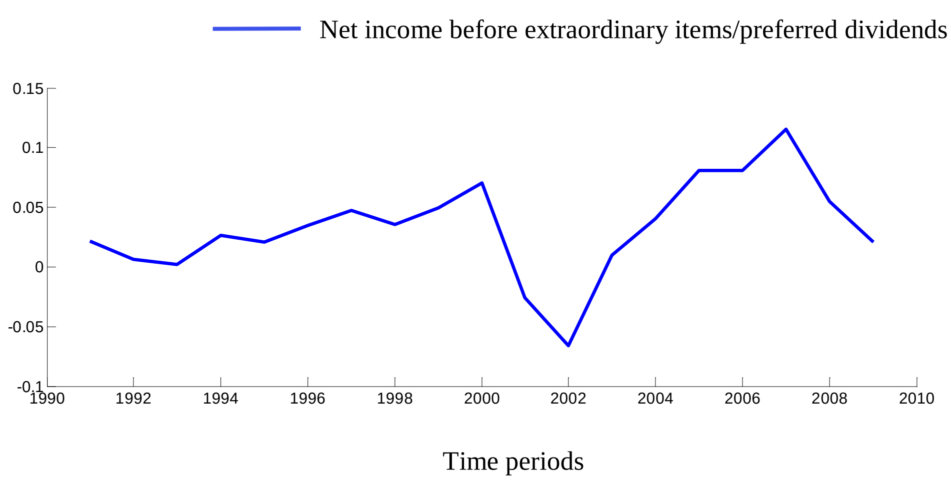


Figure 3: Trend of net income before extraordinay items/preferred dividends

The above table 4.10 shows two key findings:

- First, imposing linear information structure, the three linear information models provide a composite measure of earnings quality (EQ) that captures informativeness and persistence of earnings. Nonetheless, informativeness of earnings seems to capture *per si* all the relevant value information of earnings. In our sample, β *coefficients* capture better the informativeness of earnings alone than if we impose the linear information model (LIM) structure, that is, if we impose the behavior theoretically supported by Ohlson (1995).

- Second, the valuation coefficient of net income differs from that of total accruals, and the valuation coefficients of the major accruals components differ from each other. These findings suggest that disaggregation earnings into cash flow and total accruals, and total accruals into its four major components aid in predicting market value added. However, we found that signs and magnitudes of the coefficients do not differ significantly when the linear information model (LIM) structure is or is not imposed in estimations.

4.5.6. Comparison of market value added prediction errors

Table 4.11 presents the Mean Error (ME), Mean Absolute Error (MAE), Root Mean Squared Error (RMSE), Mean Percentage Error (MPE), Mean Absolute Percentage Error (MAPE) and Theil U statistic, for market value added value predictions obtained from estimations in which model parameters are estimated with and without imposing the linear information model (LIM) structure.

Table 4.11 – Cross-LIM comparisons of market value added prediction errors

	Without imposing LIM			**With imposing LIM**		
	LIM1	**LIM2**	**LIM3**	**LIM1**	**LIM2**	**LIM3**
Mean Error (ME)	0,000	0,000	0,000	0,000	0,000	0,000
Mean Absolute Error (MAE)	0,496	0,477	0,438	0,496	0,477	0,438
Root Mean Squared Error (RMSE)	0,873	0,854	0,738	0,873	0,854	0,738

Table 4.11 – Cross-LIM comparisons of market value added prediction errors

	Without imposing LIM			With imposing LIM		
	LIM1	**LIM2**	**LIM3**	**LIM1**	**LIM2**	**LIM3**
Mean Percentage Error (MPE)	-7,677	-7,085	-5,855	11,767	-16,551	-402,735
Mean Absolute Percentage Error (MAPE)	8,137	7,679	6,407	25,797	25,944	408,836
Theil U statistic	1,502	1,351	1,326	8,692	10,252	0,817

Findings relating to estimations for all three linear information models (LIMs) reveal that imposing the linear information model (LIM) structure results in significantly larger Mean Percentage Error (MPE), Mean Absolute Percentage Error (MAPE) and Theil U statistic.

Curiously the results of Mean Error (ME), Mean Absolute Error (MAE) and Root Mean Squared Error (RMSE) are the same when the linear information model (LIM) structure is and it is not impose.

Comparisons of Mean Absolute Error (MAE), without and with imposing linear information model (LIM), Root Mean Squared Error (RMSE), Mean Percentage Error (MPE), Mean Absolute Percentage Error (MAPE) and Theil U Statistic without imposing linear information model (LIM) reveals that disaggregation of earnings into cash flow and total accruals aids in predicting market value added because the values of errors metrics tend to decrease when we disaggregated the earnings.

However, when we impose linear information model (LIM) the values of Root Mean Squared Error (RMSE), Mean Percentage Error (MPE), Mean Absolute Percentage Error (MAPE) and Theil U Statistic doesn't reveal clearly that disaggregation of earnings into cash flow and total accruals aids in predicting market value added because there is not a clear downward trend in the values of errors metrics.

So, we found that prediction errors differ significantly when the linear information model (LIM) structure is imposed. Imposing the restriction there is a worse fit of the model.

This finding suggests that research designs based on residual models need not impose the model structure because doing increases prediction errors. Thus, this finding supports the efficacy of drawing inferences from valuation equations based on residual income models that do not impose the structure implied by the model.

In the next sub-section 4.5.7, we examine whether positive and negative earnings firms affects our inferences, attending to related studies, Collins *et al.* (1997) and Hand and Landsman (1999) find that Ohlson model valuation estimates differ for positive and negative earnings firms (section 4.5.6). Finally, it is possible that prices do not fully reflect differences in valuation implications for accruals and cash flows (Sloan, 1996; Barth and Hutton, 1999; Frankel and Lee, 1998; Dechow *et al.*, 1999; Lee *et al.*, 1999).

4.5.7. Results from LIM estimations with only positive earnings sample

Knowing that markets appreciate differently the persistence of earnings and this appreciation depends on its sign, negative or positive, we decided to re-estimate the previous regressions for a sample with only positive earnings, in order to analyze the differences (tables 4.18, 4.19 and 4.20). In fact, losses (negative earnings) have a smaller impact in the market value than profits (positive earnings) of the same magnitude. The losses are not related with the growth expectations, since they are noticed as more transitory than profits (convexity in earnings valuation). Losses have a dampening effect in the measures that evaluate the information content of earnings, therefore the losses cases have a much weaker association with returns than profit cases.

The sample was divided in a subsample, which has only profitable firm-years, in order to examine the effect of losses on the regression estimates, that is, the asymmetry in earnings response. According to Hayn (1995)[41], if loss cases have a dampening effect on the measures of the information content of earnings, the following relation between the regression parameters between all sample (loss and profitable firm-years) and subsample (only profitable firm-years) should hold:

$$\text{ERC}(R^2)_{\text{full sample}} < \text{ERC}(R^2)_{\text{profits}}$$

[41] Hayn (1995) calculates for each firm the earnings response coefficient (ERC), which is the coefficient in a regression of stock returns on reported earnings. Her results suggest that ERCs are larger for firms reporting positive earnings than for firms reporting losses.

Table 4.12 sumarizes the sample selection procedure for positive earnings sample.

Table 4.12 – Sample selection (positive earnings sample)

	Firm-years observations
Datastream data base **All available non-financial listed firms for primary variables**	**9.877**
Less:	
Missing data after to remove negative book values equity (BVE_{it}) observations and negative net income (NI_{it}) observations:	(1.525)
Missing data after compute changes for some primary variables (ΔREC_{it} , ΔINV_{it} , ΔPAY_{it}):	(463)
Missing data after compute some secondary variables (NI^{a}_{it} , ACC_{it} , $DIFmbv_{it}$):	(39)
Missing data after to remove negative market value added observations (Badwill, $DIFmbv_{it}$ < 0) and negative abnormal earnings observations (NI^{a}_{it}):	(2.164)
Missing data after to consider a minimum of 3 years consecutive observations:	(17)
Missing data after outliers removed:	(41)
Size of the final sample	***5.628***

Notes:
The sample comprises 5.628 firm-year observations for the period 1990-2009, in relation to 2.340 firms. The variables were defined in the previous table 4.1.

We exclude firm-year observations with negative net income and negative abnormal earnings, which data has not a minimum of three years consecutive of observations and we exclude extreme observations. This gives a final sample of 5.628 firm-year observations for all period 1990-2009.

Table 4.13 presents descriptive statistics for each variable used in the estimated equations, for the period 1990-2009.

Table 4.13 – Descriptive statistics for datastream firm-year observations, 1990-2009

Variable	Mean	Median	Standard deviation	Min.	Max.	Skewness	Kurtosis
Net income (NI_{it} **)**	123,840	8,264	662,750	0,001	22.710	15,84	347,94
Abnormal earnings (NI_{it}^{a} **)**	93,073	4,784	530,600	0,000	17.805	16,09	353,52
Total accruals (ACC_{it} **)**	-121,040	-5,071	638,710	-14.387,00	5.537	-9,83	124,83
$\frac{ACC_{it}}{TA_{it}}$	- 3,68%	- 3,67%	9,24%	- 267,66%	898,68%	47,81	4582,5
$\frac{NI_{it}^{a}}{TA_{it}}$	4,24%	3,24%	3,83%	0,00%	20,56%	1,47	2,368

The descriptive statistics in table 4.13 reveal that, by definition, the variables transformed (net income and abnormal earnings) only present positive values for the mean, median, minimum and maximum.

Table 4.14 – Correlations, with Pearson (Spearman) correlations above (below) the diagonal

	$\frac{MVE_{it}}{TA_{it}}$	$\frac{BVE_{it}}{TA_{it}}$	$\frac{NI_{it}^{a}}{TA_{it}}$	$\frac{ACC_{it}}{TA_{it}}$	$\frac{\lvert\Delta INV_{it}\rvert}{REV_{it}}$	$\frac{\lvert\Delta REC_{it}\rvert}{REV_{it}}$	$\frac{\lvert\Delta PAY_{it}\rvert}{REV_{it}}$	$\frac{\lvert\Delta DEP_{it}\rvert}{REV_{it}}$
$\frac{MVE_{it}}{TA_{it}}$	1	0,1755** **(0,000)**	0,5565** **(0,000)**	0,0334** **(0,003)**	-0,041** **(0,000)**	0,0449** **(0,000)**	0,0457** **(0,000)**	0,0668** **(0,000)**
$\frac{BVE_{it}}{TA_{it}}$	0,1747** **(0,000)**	1	0,0757** **(0,000)**	0,0350** **(0,003)**	0,0640** **(0,000)**	0,1294** **(0,000)**	0,0400** **(0,000)**	0,1464** **(0,000)**
$\frac{NI_{it}^{a}}{TA_{it}}$	0,5254** **(0,000)**	0,0658** **(0,000)**	1	0,0413** **(0,0170)**	-0,0115 **(0,4928)**	0,1032** **(0,000)**	0,0200 **(0,2292)**	-0,0245** **(0,1498)**
$\frac{ACC_{it}}{TA_{it}}$	0,0166 **(0,1468)**	0,0473** **(0,000)**	0,0533** **(0,002)**	1	0,0831** **(0,000)**	0,0658** **(0,000)**	-0,0265* **(0,0188)**	-0,2188** **(0,0000)**
$\frac{\lvert\Delta INV_{it}\rvert}{REV_{it}}$	-0,0761** **(0,000)**	0,0132 **(0,2480)**	-0,0183 **(0,2749)**	0,0431** **(0,000)**	1	0,1632** **(0,000)**	0,2267** **(0,000)**	-0,0570** **(0,000)**
$\frac{\lvert\Delta REC_{it}\rvert}{REV_{it}}$	0,0334** **(0,0036)**	0,0919** **(0,000)**	0,1046** **(0,000)**	0,0971** **(0,000)**	0,0621** **(0,000)**	1	0,3502** **(0,000)**	0,1329** **(0,000)**

Table 4.14 – Correlations, with Pearson (Spearman) correlations above (below) the diagonal

	$\frac{MVE_{it}}{TA_{it}}$	$\frac{BVE_{it}}{TA_{it}}$	$\frac{NI^a_{it}}{TA_{it}}$	$\frac{ACC_{it}}{TA_{it}}$	$\frac{\lvert\Delta INV_{it}\rvert}{REV_{it}}$	$\frac{\lvert\Delta REC_{it}\rvert}{REV_{it}}$	$\frac{\lvert\Delta PAY_{it}\rvert}{REV_{it}}$	$\frac{\lvert\Delta DEP_{it}\rvert}{REV_{it}}$
$\frac{\lvert\Delta PAY_{it}\rvert}{REV_{it}}$	0,0614** **(0,000)**	-0,0159 **(0,1637)**	0,0326 **(0,0508)**	-0,0604** **(0,000)**	0,2052** **(0,000)**	0,3024** **(0,000)**	1	0,1613** **(0,000)**
$\frac{\lvert\Delta DEP_{it}\rvert}{REV_{it}}$	0,1052** **(0,000)**	0,1552** **(0,000)**	-0,0136 **(0,4245)**	-0,2628** **(0,000)**	-0,0577** **(0,000)**	0,0687** **(0,000)**	0,1152** **(0,000)**	1

Notes: ** Correlation is statistic significance for level of 1%.
* Correlation is statistic significance for level of 5%.
P-values (coefficients significant) are in boldface below the correlations.

Table 4.14 reveals that, in spite of most of the variables have a linear association (correlation) significant, for a 1% significance level, most of them are weakly correlated with each other.

Like we did in the previous sub-section 4.4.3, we present below a brief statistical description about frequency of losses, distribution of firms in relation to losses years and the relation between losses and firm size.

A) Frequency of losses

Table 4.15 presents the relative frequency of losses. Losses are fairly common, appearing in 53,9% of all firm-years. There is a dramatic increase in the frequency of losses over time, from about 37,01% in the early 1990's to over 64,41% in the late 2000's, as we saw with the frequency of negative book value equity in section 4.4.3. These increase is only partially due to the changing composition of firms covered by *Thomson Datastream and WorldScope database*.

The last years, 2008 and 2009, were the years that had, in relative terms, a higher percentage of losses in relation to the total firm-years observations, 29,9% and 37,6% respectively. The year of 1990 was the year with a lowest losses incidence.

Table 4.15 – Frequency of losses

Year	Total number of firms	Total firms with losses	% of firms with losses
All years	2340	1261	53,9
1990-1999	1386	513	37,0
2000-2009	1790	1153	64,4
1990	712	76	10,7
1991	745	111	14,9
1992	778	144	18,5
1993	803	150	18,7
1994	814	109	13,4
1995	842	105	12,5
1996	1053	120	11,4
1997	1173	139	11,9
1998	1265	164	12,9
1999	1373	197	14,3
2000	1451	233	16,1
2001	1479	345	23,3
2002	1543	423	27,4
2003	1604	407	25,4
2004	1656	327	19,7
2005	1709	334	19,5
2006	1720	294	17,1
2007	1715	304	17,7
2008	1709	512	29,9
2009	1618	608	37,6

As already mentioned, in section 4.4.3, the variability in the frequency of losses is partly explained by: structural changes in the economy, operations of firms mergers and firms acquisitions, change in accounting standards and accounting principles, etc.

The following figure 4 shows the frequency of losses by year:

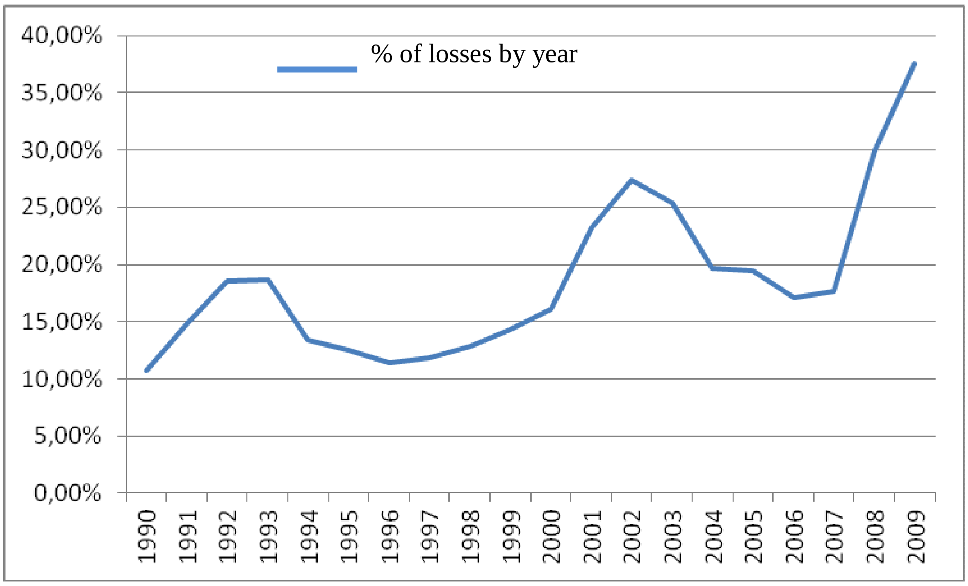


Figure 4: Percentage of losses years

The incidence of losses is shared by almost all firms. As table 4.16 indicates, the majority of firms with at three years of data (53,89%) report losses during the sample period, 12,82% of firms report at least one loss and one-fifth of them have two or three losses during the 20-year sample period. Only 46,11% of firms report always positive income.

Table 4.16 – Distribuition of firms with at least three years of data, by the number of years with losses (negative income from continuing operations)

Number of loss years	Number of firms	% of firms
All firms	2340	100,0
0	1079	46,1
1	300	12,8
2	217	9,3
3	172	7,4
4	132	5,6
5	99	4,2
6	95	4,1
7	70	2,9

Table 4.16 – Distribuition of firms with at least three years of data, by the number of years with losses (negative income from continuing operations)

Number of loss years	Number of firms	% of firms
8	54	2,3
9	40	1,7
10	27	1,2
11	21	0,9
12	9	0,4
13	9	0,4
14	5	0,2
15	4	0,2
16	2	0,0
17	3	0,1
18	0	0,0
19	2	0,0
20	0	0,0

B) Losses and firm size

The loss phenomenon is strongly linked to firm size. Table 4.17 shows the probability of a loss for ten equal-sized portfolios of firm-years ordered by the market value of the firms' equity[42]. The results reveal a monotic relation between firm size and the probability of a loss, except for the passage of the portfolio 7 to portfolio 8, where there is a slight increase in the number of years with losses, from 118 to 127. The probability of incurring a loss in a given year is only 7,01% for the largest firms (portfolio 10), compared with 36,8 % for the smallest firms (portfolio 1).

[42] Ten portfolios are the same that we used in the previous table 4.6, portfolios are formed each year based on the market value of the firms' equity at the end of the previous year.

Table 4.17 – Probability of losses by portfolios ordered by firm size, where firm size is measured as the market value of equity at the end of each year

Portfolio	Number of firm-years	Number of loss years	% of loss years
All portfolios	2340	1261	53,9
1 (smallest firms)	1227	451	36,8
2	1226	313	25,5
3	1227	259	21,1
4	1227	183	14,9
5	1227	162	13,2
6	1226	152	12,4
7	1227	118	9,6
8	1227	127	10,4
9	1226	99	8,1
10 (largest firms)	1227	86	7,0

According to Hayn (1995: 130) "the results relating loss frequency to firm size suggest that if the presence of losses induces a downward bias in the earnings response coefficient, the magnitude of that bias must vary by firm size: it should be more pronounced for small firms and almost nonexistent for larger firms. Therefore, these results may have implications for studies on the effect of firm size on the information content of earnings" (see, Collins *et al.,* 1987; Collins and Kothari, 1989; Freeman, 1987).

Considering the brief statistical description about frequency of negative book value equity and frequency of losses, we can conclude that the results are similar, once that losses and negative book value equity are common in all firm-years observations, this is, the incidence of losses and negative book value are shared by almost all firms and there is an increase in their frequency over time. These findings may be related to real economic activity, that is, economic cycles. This issue will be explore in future research.

On the other hand, we can conclude that in general the frequency of negative book value equity and losses decrease as firm size increases. The results reveal a monotic relation between firm size and the probability of a loss.

Table 4.18 presents regression coefficients for the market value added for the three linear information models (LIM1, LIM2 and LIM3), equations [4.1a], [4.2a] and [4.3a].

Table 4.18 – Abnormal earnings equations (positive earnings sample) – Persistence coefficients and predictability coefficients

Variable	Pred. Sign	**Equation [4.1a]** Coef. (t-stat.)	**Equation [4.2a]** Coef. (t-stat.)	**Equation [4.3a]** Coef. (t-stat.)
Observations		9.362	9.299	7.196
NI^a_{it-1}	+	**+ 0,4117***** (26,73)	**+ 0,4273***** (27,82)	**+ 0,3942***** (22,36)
ACC_{it-1}	-		**- 0,0892***** (-11,14)	
ΔREC_{it-1}	+/-			**- 0,001** (-0,13)
ΔINV_{it-1}	+/-			**- 0,008** (-1,09)
ΔPAY_{it-1}	+/-			**+ 0,008** (0,98)
DEP_{it-1}	+/-			**- 0,0518***** (-3,11)
v_{it}	+	**+ 0,0017** (0,92)	**+ 0,0044** (0,28)	**+ 0,0191** (1,03)
$\bar{R}^2$		57,83%	58,51%	58,57%
White test		Chi2(5) = 887,27 **p-value** = 0,000	Chi2(5) = 886,19 **p-value** = 0,000	Chi2(27) = 834,18 **p-value** = 0,000
Test F		F(1308, 8051) = 2,09 **p-value** = 0,000	F(1301, 7994) = 2,08 **p-value** = 0,000	F(1000, 6189) = 2,02 **p-value** = 0,000
Breusch-Pagan		Chi2(1) = 20,92 **p-value** = 0,000	Chi2(1) = 27,05 **p-value** = 0,000	Chi2(1) = 4,80 **p-value** = 0,028
Test Hausman		Chi2(2) = 695,81 **p-value** = 0,0000	Chi2(3) = 713,57 **p-value** = 0,0000	Chi2(6) = 722,40 **p-value** = 0,0000
Estimation method		Fixed Effects	Fixed Effects	Fixed Effects

To measure earnings persistence we use three different abnormal earnings equations, which integrates our different linear information models, respectively:

Equation [4.1a]: $NI^a_{it} = \omega_{10} + \omega_{11} NI^a_{it-1} + \omega_{12} v_{it} + \varepsilon_{1it}$

Equation [4.2a]: $NI^a_{it} = \omega_{10} + \omega_{11} NI^a_{it-1} + \omega_{12} ACC_{it-1} + \omega_{13} v_{it} + \varepsilon_{1it}$

Equation [4.3a]: $NI^a_{it} = \omega_{10} + \omega_{11} NI^a_{it-1} + \omega_{12} \Delta REC_{it-1} + \omega_{13} \Delta INV_{it-1} + \omega_{14} \Delta PAY_{it-1} + \omega_{15} DEP_{it-1} + \omega_{16} v_{it} + \varepsilon_{1it}$

Table 4.18 – Abnormal earnings equations (positive earnings sample) – Persistence coefficients and predictability coefficients

Notes: The variables were defined previously. *** statistic significance for level of 1%. ** statistic significance for level of 5%. * statistic significance for level of 10%.

Table 4.19 – Accruals autoregression

Variable	**Pred. Sign**	**Equation [4.2b]** Coef. (t-stat.)
Observations		17.135
ACC_{it-1} (γ_{22})	+	**+ 0,1792***** (24,25)
$\bar{R}^2$		36,83%
White test		Chi2(2) = 1159,25 **p-value** = 0,000
Test F		F(1670, 15463) = 3,46 **p-value** = 0,000
Breuch-Pagan		Chi2(1) = 976,77 **p-value** = 0,000
Test Hausman		Chi2(1) = 807,39 **p-value** = 0,000
Estimation method		Fixed Effects

To measure accruals autoregression, we use the follow equation, which integrates our linear information models 2 (LIM2):

Equation [4.2b]: $ACC_{it} = \gamma_{20} + \gamma_{22} ACC_{it-1} + \varepsilon_{2it}$

Note:
The variable were defined previously.
*** statistic significance for level of 1%.
** statistic significance for level of 5%.
* statistic significance for level of 10%.

Table 4.20 – Regression statistics for period 1990-2009

		Without LIM Structure			With LIM Structure		
Variable	**Pred.Sign**	**LIM 1** Coef. (t-stat.)	**LIM 2** Coef. (t-stat.)	**LIM 3** Coef. (t-stat.)	**LIM 1** Coef. (t-stat.)	**LIM 2** Coef. (t-stat.)	**LIM 3** Coef. (t-stat.)
Observ.		4808	4788	4010	4808	4788	4010
NI_{it}^{a}	+	**+ 8,4599***** (24,90)	**+ 9,3111***** (26,93)	**+ 8,5192***** (24,21)	**+ 0,855***** (18,85)	**+ 0,892***** (36,89)	**+ 0,922***** (16,99)
ACC_{it}	-		**- 2,9428***** (-10,06)			**- 0,176***** (-5,18)	
ΔREC_{it}	+/-			**+ 0,442*** (1,92)			**+ 0,0037** (0,41)
ΔINV_{it}	+/-			**+ 0,150** (0,65)			**- 0,0016** (-0,14)
ΔPAY_{it}	+/-			**+ 0,547*** (1,78)			**+ 0,0183** (1,48)
DEP_{it}	+/-			**- 0,504** (-1,03)			**- 0,0296** (-1,34)
v_{it}	+	**+ 0,5699***** (7,05)	**+ 0,3934***** (4,75)	**+ 1,663***** (4,37)	**+ 3,252***** (9,69)	**+ 3,246***** (9,62)	**+ 4,4255***** (12,17)
$\bar{R}^2$		58,71%	59,29%	58,89%	8,43%	8,58%	9,98%
White test		Chi2(5) = 144,41 **p-value** = 0,000	Chi2(9) = 133,86 **p-value** = 0,000	Chi2(27)=205,58 **p-value** = 0,000			
Test F		F(527, 4278)=7,297 **p-value** = 0,000	F(526, 4258)=7,326 **p-value** = 0,000	F(448, 3555)=6,834 **p-value** = 0,000			
Breuch-Pagan		Chi2(1) = 3814,93 **p-value** = 0,000	Chi2(1) = 3854,72 **p-value** = 0,000	Chi2(1) = 2380,36 **p-value** = 0,000			
Test Hausman		Chi2(1) = 68,095 **p-value** = 0,000	Chi2(3) = 62,428 **p-value** = 0,0000	Chi2(6) = 92,501 **p-value** = 0,000			
Estimation method		Fixed Effects	Fixed Effects	Fixed Effects			
Wald test					Test statistics > Critical Value **27958,9 > 3,841**	Test statistics > Critical Value **117151,4 > 5,991**	Test statistics > Critical Value **24548,83 > 11,071**

We use three different valuation equations, this is, three linear information models (LIM1, LIM2 and LIM3):

Table 4.20 – Regression statistics for period 1990-2009

Equation [4.1b]: $\underbrace{\left(MVE_{it} - BVE_{it}\right)}_{Dif_{MBV}} = \beta_0 + \beta_1 NI_{it}^{a} + \beta_2 v_{it} + \mu_{it}$

Equation [4.2c]: $\underbrace{\left(MVE_{it} - BVE_{it}\right)}_{Dif_{MBV}} = \beta_0 + \beta_1 NI_{it}^{a} + \beta_2 ACC_{it} + \beta_3 v_{it} + \mu_{it}$

Equation [4.3f]: $\underbrace{\left(MVE_{it} - BVE_{it}\right)}_{Dif_{MBV}} = \beta_0 + \beta_1 NI_{it}^{a} + \beta_2 \Delta REC_{it} + \beta_3 \Delta INV_{it} + \beta_4 \Delta PAY_{it} + \beta_5 DEP_{it} + \beta_6 v_{it} + \mu_{it}$

Notes:
The variables were defined previously.

*** statistic significance for level of 1%.
** statistic significance for level of 5%.
* statistic significance for level of 10%.

We present these statistics to provide descriptive evidence on the magnitudes and signs of the valuation parameter estimates and the effects on the estimates of imposing the linear information model (LIM) structure, and to facilitate comparison with prior research.

Performing *F*, *Breusch-Pagan* and *Hausman* tests we conclude that fixed effects model improves our results and in all models we emphasized the heteroscedasticity, performing White test, we reject the null hypothesis with a *p-value* = 0.000 for, consequently we correct the estimations using heterogeneity adjusted model, namely, using a fixed effects model we take into account the individual heterogeneity.

The findings relating to table 4.18 (abnormal earnings equations – persistence and predictability coefficients), table 4.19 (accruals autoregression – persistence coefficients) and in table 4.20 (valuation equations – without and with linear information model) are consistent with prior research (Barth *et al.,* 1999 and 2005; Dechow *et al.*, 1999; Hand and Landsman, 1999) and with the previous results presented in table 4.7, table 4.8 and table 4.10, but with magnitudes of the valuation parameter estimates and values of adjusted R^2 better performed.

According to Hayn (1995), Collins *et al.* (1997) and Collins *et al.* (1999), we know that negative earnings are less persistent than positive earnings and as expected the persistence of abnormal earnings as measured by ω_{11} is higher for the positive earnings subsample and it is always significantly positive for all models. For positive earnings subsample, the persistence coefficient estimates (*t*-statistics) of abnormal earnings report in above table 4.18 are 0.4117, 0.4273 and 0.3942 (26.73, 27.82 and 22.36) versus 0.1819, 0.3764 and 0.2077 (10.70, 24.58 and 23.54) the persistence coefficient estimates (*t*-statistics) of abnormal earnings report in table 4.7 (full sample).

Moreover, the ω_{12} coefficient of the equation [4.2a], the predictability coefficients of total accruals on abnormal earnings equation is significantly negative and it is comparable with its value reports in table 4.7 (full sample), but less negative in relation to full sample, suggesting that the lower the proportion of current earnings attributable to accruals, the higher future abnormal earnings will be. The predictability coefficient estimates (*t*-statistics) of total accruals for positive earnings subsample is -0.0892 (-11.14) in table 4.18, versus -0.2512 (-20.45) for all sample in table 4.7.

Also as expected, the autocorrelation, or persistence, of the contemporaneous total accruals on future total accruals, γ_{22}, is significantly positive and it is higher than its value based on the full sample, however it is less than 1.00 indicating stationary autoregressive processes for accruals. The coefficient (*t*-statistics) estimates for positive earnings subsample, γ_{22}, is 0.1792 (24.25) in table 4.19, versus 0.051 (7.53) for all sample in table 4.8.

In particular, the valuation coefficients on abnormal earnings in the linear information model 1 (LIM1), β_1, is significantly positive for all models and it is higher for the positive earnings subsample than for full sample, with and without imposing the linear information model (LIM) structure. As expected, the incremental valuation coefficient of total accruals in equation [4.2c], β_2, is significantly negative when the linear information model (LIM) structure is not imposed and when it is imposed. The fact that the coefficient of total accruals differs from that of other components of abnormal earnings also suggests that disaggregating earnings into cash flow and total accruals can enhance market value added prediction in a positive earnings subsample.

The valuation coefficient, of other information, v_{it}, is also always significantly positive in the three linear information model (LIM), equation [4.1b], equation [4.2c] and equation [4.3f] for positive earnings subsample, when linear information model (LIM) structure is or is not imposed, which indicates that other information could be significant in determining current maket value added.

We can also observe that for positive earnings subsample, the findings in linear information model 3 (LIM3) also permit separate coefficients for the four accrual components, which indicate substantial differences in coefficients across the components, with and without imposing linear information model (LIM).

Attending to the results report in table 4.18, 4.19 and 4.20, it is important to point out that the magnitudes of the valuation parameter estimates and the values of adjusted R^2 are better performed in regressions in a positive earnings subsample.

If we compare the results of table 4.10 with the results of table 4.20, we can conclude that the following relation between the regression parameters of the subsamples is respected:

$$\text{ERC}(R^2)_{\text{full sample}} < \text{ERC}(R^2)_{\text{profits}}$$

So, we can conclude that loss cases have a dampening effect on the measures of the information content of earnings.

The results of the Wald test reported in the above table 4.20, positive earnings subsample, also present that the test statistic exceeds the critical value in all linear information models (LIM), equation [4.1b], equation [4.2c] and equation [4.3f], so, in this case Wald test also rejects the null hypothesis (H_0), this is, it rejects the restricted model in favor of the unrestricted model.

Similarly to what we did previously, in the figure 5, above, we report an average of only positive net income before extraordinary items/preferred dividends for different firms considered in our sample and we can see that in all sample period, 1990-2009, there is a growing trend of positive net income before extraordinary items/preferred dividends, then this can be another possible reason why restricted model is rejected in favor of the unrestricted model.

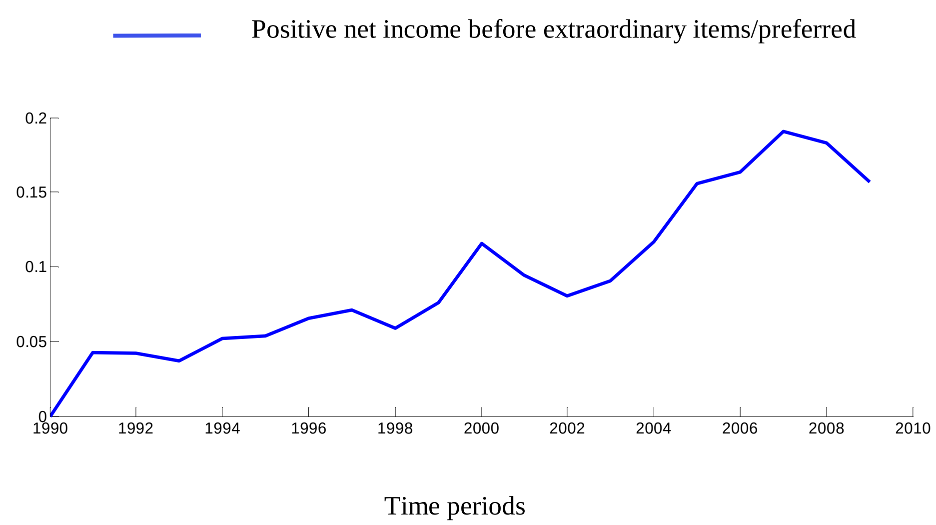


Figure 5: Trend of positive net income before extraordinary items/preferred dividends

4.6. Summary and concluding remarks

In this chapter, we use the Ohlson (1999) framework, which extends Ohlson (1995) and Feltham and Ohlson (1995), by modelling earnings components, just as Barth *et al.* (1999 and 2005). We rebuild the relation between contemporaneous and future earnings, in line with the underlying motivation of the linear information dynamics and considering the earnings quality concept, that is, to the persistence, the predictability and the informativeness of earnings.

This modelled extension suggests that the value relevance of an earnings component depends on its ability to predict future abnormal earnings incremental to abnormal earnings and the persistence of the component.

We examined whether differences between the market and book value of common equity (market value added) can be explained by the different value relevance of earnings components: accruals and cash flow. And we tested if the disaggregation of earnings into cash flow and total accruals, and total accruals into its four major components, has different impact in $\beta\,coefficients$ information content (LIM2 and LIM3 in the research design). To test whether imposing the linear information model (LIM) structure aids in predicting market value added, we compared the magnitude and signs of the valuation parameter estimates when the linear information model (LIM) structure is imposed with those when it is not and we used the Wald test.

Our key findings are:

- Redesigning the linear information model (LIM) structure of accounting information we obtain in the $\beta\,coefficients$ a composite measure of earnings quality (EQ) that simultaneously captures the persistence (ω), the predictability (γ) and the *informativeness* of earnings (β) and its components, building a composite and tridimensional measure of earnings quality (EQ). Informativeness of earnings seems to capture *per si* all the relevant value information of earnings. In our sample, $\beta\,coefficients$ capture better the informativeness of earnings alone than if we impose the linear information model (LIM) structure, that is, if we impose the behavior theoretically supported by Ohlson (1995).

- The valuation coefficient of net income differs from that of total accruals, and those of the four major accruals components differ from each other. These findings suggest that disaggregating earnings into cash flow and total accruals, and total accruals into its major components aid in predicting market value added. However, we found that signs and magnitudes of the coefficients do not differ significantly when the linear information model (LIM) structure is or is not imposed in estimations;

– Predictions errors differ significantly when the linear information model (LIM) structure is imposed. Imposing the restriction there is a worse fit of the model. These findings support the efficacy of drawing inferences from valuation equations based on residual income models that do not impose the structure implied by the model.

Taking to account the convexity of earnings (Hayn, 1995), we tested our relations in a subset of valuation relevance, that is, when there are abnormal earnings ($NI_{it}^{a} > 0$). The findings in table 4.20 suggest that loss cases have a dampening effect on the measures of the information content of earnings. Therefore the losses cases have a much weaker association with returns than profit cases. When we consider only positive earnings the magnitudes of the valuation parameter estimates and the values of adjusted R^2 are better performed. Therefore, convexity of earnings must be taken into account to assess the informativeness and persistence of earnings.

Chapter 5

Earnings Quality and Valuation: Industry Estimations

5.1. Introduction

In chapter 1, section 1.3, we explain that quality of accounting information is a function of its relevance, what means of its predictive, informativeness and confirmatory value. Information has predictive value if it has value as an input to predictive processes used by investors to form their own expectations about the future and earnings are important for evaluation effects, or in other words, the investors see in earnings a valuable information source to assess the firm value, and, in this sense, earnings quality concept is a way to assess the relevance, the reliability of earnings, in short, the informativeness of earnings, in terms of value relevance.

Considering our rebuilding of the relation between contemporaneous and future earnings, in order to the persistence, in terms of sustainability of earnings, to the predictability and the informativeness of earnings, that is, considering the earnings quality concept, our objective in this chapter is to test, in separate industry estimation, and according to the system of equations for each earnings components considered, if:

- Informativeness of earnings ($\beta\, coefficients$) is significantly higher in portfolios of industries with high earnings quality (high persistence of abnormal earnings and low (high) predictability of accruals (cash flows)) compared to portfolios of industries with low earnings quality (low persistence of abnormal earnings and high (low) predictability of accruals (cash flows));

- Explanatory power of earnings (R^2) to explain *market value added* is significantly higher in portfolios of industries with high earnings quality (high persistence of abnormal earnings and low (high) predictability of accruals (cash flows)) compared to portfolios of industries with low earnings quality (low persistence of abnormal earnings and high (low) predictability of accruals (cash flows));

The remainder of this chapter is organized as follows: section 5.2. describes the hypotheses and the research design, section 5.3. describes the sample and data, and section 5.4. presents the results. Section 5.5. summarizes and concludes the study.

5.2. Hypotheses and research design

Based on previous essay (chapter 4), our model proposed suggests that the value relevance of an earnings component depends on its ability to predict future abnormal earnings incremental to abnormal earnings and on the persistence of the component.

5.2.1. Hypotheses

According to the system of equations, for each earnings component, considered, we predict that a higher quality of earnings measured by the intersection of higher persistence of abnormal earnings (ω_{11}) and low (high) predictability of accruals (cash flows) (ω_{12}) will be associated with higher explanatory power and estimated coefficients (β *coefficients*) from regressions of *market value added* on earnings. Formally, we have two sets of hypotheses (H_{1a}-H_{1b}, H_{2a}-H_{2b}):

H_{1a}: Informativeness of earnings (β *coefficients*) is significantly higher in portfolios of industries with high earnings quality (high persistence of abnormal earnings and low predictability of accruals) compared to portfolios of industries with low earnings quality (low persistence of abnormal earnings and high predictability of accruals);

H_{1b}: Explanatory power of earnings (adjusted R^2) to explain *market value added* is significantly higher in portfolios of industries with high earnings quality (high persistence of abnormal earnings and low predictability of accruals) compared to portfolios of industries with low earnings quality (low persistence of abnormal earnings and high predictability of accruals).

H_{2a}: Informativeness of earnings (β *coefficients*) is significantly higher in portfolios of industries with high earnings quality (high persistence of abnormal earnings and high predictability of cash flows) compared to portfolios of industries with low earnings quality (low persistence of abnormal earnings and low predictability of cash flows);

H_{2b}: Explanatory power of earnings (adjusted R^2) to explain *market value added* is significantly higher in portfolios of industries with high earnings quality (high persistence of abnormal earnings and high predictability of cash flows) compared to portfolios of industries with low earnings quality (low persistence of abnormal earnings and low predictability of cash flows).

5.2.2. Research design

Consistent with the findings of Barth *et al.* (1999) that accrual and cash flow earnings components vary across industries, we estimate for each earnings components separately, accruals and cash flows, equations [5.1a] through [5.1c] and equations [5.2a] through [5.2c], industry by industry, pooling available firm-year observations from the period 1990-2009. The two systems of equations are:

<u>Accruals system[43]:</u>

[5.1a] $NI_{it}^{a} = \omega_{10} + \omega_{11} NI_{it-1}^{a} + \omega_{12} ACC_{it-1} + \omega_{13} v_{it} + \varepsilon_{1it}$

[5.1b] $ACC_{it} = \gamma_{20} + \gamma_{22} ACC_{it-1} + \varepsilon_{2it}$

[5.1c] $\underbrace{\left(MVE_{it} - BVE_{it}\right)}_{Dif_{MBV}} = \beta_0 + \beta_1 NI_{it}^{a} + \beta_2 ACC_{it} + \beta_3 v_{it} + \mu_{it}$

[43] The "accruals system" is the same model that we estimate in chapter 4, that is, our second linear information model (LIM2) that comprises equation [4.2a] to equation [4.2c].

Cash flows system:

[5.2a] $NI_{it}^{a} = \omega_{10} + \omega_{11} NI_{it-1}^{a} + \omega_{12} CFO_{it-1} + \omega_{13} v_{it} + \varepsilon_{1it}$

[5.2b] $CFO_{it} = \gamma_{20} + \gamma_{22} CFO_{it-1} + \varepsilon_{2it}$

[5.2c] $\underbrace{(MVE_{it} - BVE_{it})}_{Dif_{MBV}} = \beta_0 + \beta_1 NI_{it}^{a} + \beta_2 CFO_{it} + \beta_3 v_{it} + \mu_{it}$

Where,
NI_{it}^{a} is abnormal earnings, defined as earnings minus the normal return on equity book value (BVE_{it} is the common equity, WS 03501), $NI_{it}^{a} = NI_{it} - r \times BVE_{it-1}$, where r is a discount rate, which is an intertemporal constant rate. The earnings variable is calculated as net income before extraordinary items/preferred dividends (NI_{it}, WS 01551). ACC_{it} is total accruals, defined as earnings (NI_{it} ,WS 01551) minus cash flows from operations (CFO_{it}, WS 04201). MVE_{it} is the market value equity (WS 08001). Dif_{MBV} is the market value added ($Dif_{MBV} = MVE_{it} - BV_{it}$), that means, the difference between the current market and book values of common equity. v_{it} is the *other information*. ε_{1it} and μ_{it} are the random disturbance term and $i = 1,...,N\ Firms$ and $t = 1,...,T\ Period$. All variables are sacled by total assets (TA_{it}, WS 02999).

The objective of this study is to provide insights into the characteristics of the accrual and cash flow components of earnings that affect their relation to portfolios of industries with high and low earnings quality.

As we said before, previous chapter 4, in equation [5.1a] and [5.2a], ω_{11} reflects the persistence of abnormal earnings, so the autoregressive coefficient (ω_{11}) is an earnings quality construct which measures the earnings persistence.

The coefficient of the earnings component (ω_{12}), also in equation [5.1a] and [5.2a], reflects the incremental effect on the forecast of abnormal earnings knowing the different earnings components (accruals and cash flows). For us, and similarly with Barth *et al.* (1999 and 2005), the coefficient ω_{12} measures the predictability of earnings components. In this context, predictive ability is the ability of current earnings components to predict future earnings. We predict lower predictability of accruals with respect to future earnings, so, we predict ω_{12} < 0 for accruals and ω_{12} > 0 for cash flows. Consequently, we predict that low predictability of accruals or high predictability of cash flows leads to high earnings quality and inversely, high predictability of accruals or low predictability of cash flows leads to low earnings quality. In this sense, we expect that accruals and cash flows have different abnormal earnings forecasting ability. We expect a negative relation for accruals, indicating that abnormal earnings is less persistent when accruals comprise a larger proportion of current earnings.

Equations [5.1c] and [5.2c] are our valuation formula and attending to the earnings response coefficient (ERC) literature we can (re)interpret the β *coefficients* of the valuation equations as a proxy of the informativeness of earnings.

The sign of ω_{12} determines the sign of β_2. The higher predictive ability of the component for future abnormal earnings, the larger, in absolute value, will be β_2. Second, the higher is the persistence parameter, γ_{22}, the higher is β_2. This positive relation between persistence and value relevance is consistent with predictions made and tested in prior research (*e.g.*, Lipe, 1986; Kormendi and Lipe, 1987; Barth *et al.*, 1990 and 1992). Third, β_2 is similarly dependent on the persistence of abnormal earnings, ω_{11}, *i.e.*, the higher the persistence of abnormal earnings, the higher is β_2 and the bigger ω_{11} is, the bigger β_1 will be.

Analogous to the interpretation of ω_{12} in equation [5.1a] and [5.2a], β_2 reflects the incremental effect on valuation from knowing accruals or cash flows. If both earnings components have the same relation with equity value, β_2 will equal zero, and knowing that component of earnings does not aid in explaining equity value.

We estimate the accrual sytem model (equation [5.1a] to equation [5.1c]) and cash flow system model (equation [5.2a] to equation [5.2c]) without impose the linear information model (LIM) because in the previous chapter 4, we found that, for our sample, research designs based on residual models need not impose the model structure, once imposing the restriction results in a worse fit of the model.

In order to build our two portfolios, portfolios of industries with high earnings quality and portfolios of industries with low earnings quality, we use three procedures after to estimate the accrual system model and the cash flow system model for all firms-years:

1) We divide the estimated coefficients (ω_{11} and ω_{12}) from equations [5.1a] and [5.2a] into three classes – high, medium and low earnings quality. We then form four portfolios of industries based on high and low scores: (1) high persistence of abnormal earnings and low (high) predictability of accruals (cash flows); (2) high persistence of abnormal earnings and high (low) predictability of accruals (cash flows); (3) low persistence of abnormal earnings and low (high) predictability of accruals (cash flows) and (4) low persistence of abnormal earnings and high (low) predictability of accruals (cash flow). The portfolio (1) is a portfolio of high earnings quality, the portfolios (2) and (3) are two portfolios of medium earnings quality, and the portfolio (4) is a portfolio of low earnings quality (table A.1, appendix 11).
2) We use the same procedure for coefficients (β_1, β_2) from equations [5.1c] and [5.2c] (table A.2, appendix 11).
3) We also divide the adjusted R^2, that is, the explanatory power of the valuation equations ([5.1c] and [5.2c]) in two classes: high and low earnings quality (table A.3, appendix 11).

To divide the industries in the three classes (high, medium and low earnings quality), we use the mean values of the estimated coefficients (ω_{11}, ω_{12}, β_1, β_2) and the mean value of the adjusted R^2 as a reference measure. In appendix 10, we present the tables with the results of these procedures. Then, we synthesize in a single table the results of the above procedures mentioned in order to obtain our two main portfolios: industries with high earnings quality and industries with low earnings quality.

5.3. Sample selection and descriptive statistics

Our sample consists in the same all domestic listed firms used in the chapter 4 and the sample selection procedure was the same, namely, we require listed firms with consolidated financial statements, excluding bank institutions and insurance companies, with at least three consecutive years of financial and accounting information, and we treat as missing observations those that are in the extreme top and bottom first percentile.

Tables 5.1, 5.2 and 5.3 present descriptive statistics for each variable used in the estimating equations in all period 1990-2009.

Table 5.1 – Descriptive statistics for datastream firm-year observations, 1990-2009

	Variable	Mean	Median	Standard deviation	Min.	Max.	Skewness	Kurtosis
Input Variables of the Models (Relative values)	$\frac{MVE_{it}}{TA_{it}}$	86,36%	62,67%	92,10%	0,63%	1348,6%	4,71	36,27
	$\frac{BVE_{it}}{TA_{it}}$	44,39%	42,19%	21,59%	0,00%	489,28%	0,74	8,96
	$\frac{ACC_{it}}{TA_{it}}$	- 4,84%	- 3,91%	12,95%	- 668,12%	275,31%	-19,75	842,61
	$\frac{NI_{it}^{a}}{TA_{it}}$	0,19%	1,43%	11,97%	- 165,76%	166,34%	-3,18	33,75
	$\frac{CFO_{it}}{TA_{it}}$	4,73%	7,20%	25,72%	0,00%	463,49%	-14,03	344,60

Notes:

NI_{it}^{a} is abnormal earnings, defined as earnings minus the normal return on equity book value (BVE_{it} is the common equity, WS 03501), $NI_{it}^{a} = NI_{it} - r \times BVE_{it-1}$, where r is a discount rate, which is an intertemporal constant rate. The earnings variable is calculated as net income before extraordinary items/preferred dividends (NI_{it}, WS 01551). MVE_{it} is the market value equity (WS 08001). Dif_{MBV} is the market value added ($Dif_{MBV} = MVE_{it} - BV_{it}$), that means, the difference between the current market and book values of common equity. ACC_{it} is total accruals, defined as earnings (NI_{it},WS 01551) minus cash flows from operations (CFO_{it}, WS 04201). TA_{it} is the total assets (WS 02999).

Table 5.1 reveals that the input variables of the models present close mean and median values, what leads us to conclude that the distributions are symmetrical or lightly asymmetric.

On average, total accruals is negative, this is consistent with prior research (*e.g.*, Sloan, 1996; Barth *et al.*, 1999 and 2005; Barth *et al.*, 2001). This is attributable to depreciation expense being included in accruals but capital expenditures being included in investing cash flows.

Table 5.2 – Correlations, with Pearson (Spearman) correlations above (below) the diagonal

	$\frac{MVE_{it}}{TA_{it}}$	$\frac{BVE_{it}}{TA_{it}}$	$\frac{NI^{a}_{it}}{TA_{it}}$	$\frac{ACC_{it}}{TA_{it}}$	$\frac{CFO_{it}}{TA_{it}}$
$\frac{MVE_{it}}{TA_{it}}$	1	0,1484** **(0,000)**	0,0862** **(0,000)**	0,0334** **(0,003)**	0,199** **(0,000)**
$\frac{BVE_{it}}{TA_{it}}$	0,1644** **(0,000)**	1	-0,128** **(0,000)**	0,0522** **(0,000)**	-0,025** **(0,000)**
$\frac{NI^{a}_{it}}{TA_{it}}$	0,3391** **(0,000)**	-0,159** **(0,000)**	1	0,1238** **(0,000)**	0,681** **(0,000)**
$\frac{ACC_{it}}{TA_{it}}$	0,0166 **(0,1468)**	0,059** **(0,000)**	0,1064** **(0,000)**	1	-0,114** **(0,000)**
$\frac{CFO_{it}}{TA_{it}}$	0,0761** **(0,000)**	-0,0216* **(0,0508)**	0,006** **(0,5922)**	-0,0431** **(0,000)**	1

Notes: ** Correlation is statistic significance for level of 1%.
* Correlation is statistic significance for level of 5%.
P-values (coefficients significant) are in boldface below the correlations.

Table 5.2 reveals that, in spite of most of the variables have a linear association (correlation) significant, for a 1% significance level, most of them are weakly correlated with each other.

Table 5.3 – Industry composition

Industry	***Firm-years observations***	**. % of observations**
Mining + Construction	8.620	9,67%
Chemicals	2.751	3,08%
	1.791	2,01%

Table 5.3 – Industry composition

Industry	***Firm-years observations***	**. % of observations**
Food and Kindred Products		
Pharmaceuticals	1.887	2,12%
Manufacturers	16.399	18,38%
Utilities	10.685	11,98%
Computers, Electronic, Software and Technology	13.065	14,65%
Industrial Transportation	1.663	1,86%
Retail	5.314	5,96%
Real Estate Investment and Services	6.788	7,61%
Services	19.864	22,27%
Unclassified	377	0,01%
Total	89.204	100,00%

We use an industry classifications very similar in Barth *et al.* (1998, 1999 and 2005). Our industry classification include Mining and Construction, Food and Kindred Products, Pharmaceuticals, Manufacturers, Utilities, Computers, Electronic, Software and Technology, Retail, Real Estate Investments and Services.

We subdivided Mining and Construction into Construction and Materials, Industrial Metals and Mining. We subdivided Manufacturers into Automobiles and Parts, General Industrials, Industrial Engineering, Oil and Gas Producers. Utilities are subdivided into Communication, Electricity, Gas, Water and Multiutilities. We also subdivided Services into Health Cares Equipments, Leisure Goods, Oil Equipments, Travel and Leisure, Media, Support Services and Alternative Energy.

We subdivided these industries to increase the likelihood that parameters are the same within each industry, and to help balance the number of sample firms across industries.

Industries with the largest concentrations of firm-year observations are Services with 22,27% of the total observations and Manufacturers with 18,38%. Industrial Transportation is the industry with less firm-years observation (1.663), this is, 1,86% of the total observations.

5.4. Results

5.4.1. Abnormal earnings equations

Table 5.4 presents regression summary statistics corresponding to the abnormal earnings equations [5.1a] and [5.2a], which measure the persistence (ω_{11}) coefficients and predictability coefficients (ω_{12}) for each of the twelve industries. Mean parameter estimates, *t*-statistics, and adjusted R^2 values across industries are summarized at the bottom of each panel (panel A and panel B) of table 5.4, table 5.5 and table 5.6.

In the next table 5.4, panel A, we can observe that the coefficient on lagged abnormal earnings, ω_{11}, is positive and significant for all industries, except to Unclassified industry, and as we have seen in the previous chapter, these results are consistent with prior research (*e.g.*, Dechow *et al.*, 1999; Hand and Landsman, 1999; Barth *et al.*, 1999 and 2005). Although the mean of 0,61 is similar to that reported in prior research, the coefficients range from 0,37 to 0,91, indicating substantial cross-industry variation in the persistence of abnormal earnings.

Moreover, consistent with predictions based on Sloan (1996), ω_{12} is significantly negative in all industries, suggesting that the lower the proportion of current earnings attributable to accruals, the higher future abnormal earnings will be. Panel A also reveals that ω_{12} varies substantially across industries. The coefficient estimates (*t*-statistics) range from -0,06 to -0,41 (-2,49 to -9,85).

In spite of, in this study, we only use the estimated coefficients ω_{11} and ω_{12} in order to divide all industries into three classes of portfolios – high, medium and low earnings quality. We can observe that the coefficient on other information, ω_{13}, varies substantially across industries. In some industries, namely, Mining and Construction, Chemicals, Computers, Electronic, Software and Technology and Real Estate Investment, this coefficient is not statistical significant, which means that *other information* does not seem to have an impact in forecasting abnormal earnings. The coefficient on other information, ω_{13}, is positive and significant for only Retail industry. For all other industries the coefficient is negative and significant, suggesting that *other information* negatively influences the determination of future abnormal earnings for these industries, this is, *other information* is a negative additive shock to next period's abnormal earnings.

Table 5.4 – Abnormal earnings equations – Persistence and predictability coefficients

Panel A: $NI^a_{it} = \omega_{10} + \omega_{11} NI^a_{it-1} + \omega_{12} ACC_{it-1} + \omega_{13} v_{it} + \varepsilon_{1it}$					
Industry	***Observ.***	NI^a_{it-1} *(t-stat.)*	ACC_{it-1} *(t-stat.)*	$\cdot\ v_{it}$ *(t-stat.)*	$\cdot\ Adj.R^2$
Mining + Construction	1999	**+ 0,54**** (9,98)	**- 0,26**** (-7,41)	**- 0,07** (-1,16)	18,79%
Chemicals	633	**+ 0,57**** (10,02)	**- 0,19**** (-2,89)	**+ 0,01** (0,09)	29,92%
Food and Kindred Products	419	**+ 0,82**** (15,12)	**- 0,16**** (-3,16)	**- 0,34**** (-4,61)	44,84%
Pharmaceuticals	349	**+ 0,91**** (19,72)	**- 0,20**** (-2,79)	**- 0,37**** (-5,48)	58,29%
Manufacturers	3752	**+ 0,67**** (20,97)	**- 0,19**** (-9,87)	**- 0,19**** (-4,95)	22,15%
Utilities	2493	**+ 0,67**** (19,53)	**- 0,17**** (-5,22)	**- 0,14**** (-3,42)	26,23%
Computers, Electronic, Software and Technology	2853	**+ 0,59**** (16,50)	**- 0,36**** (-10,88)	**- 0,05** (-1,06)	21,51%
Industrial Transportation	345	**+ 0,73**** (7,41)	**- 0,07**** (-2,81)	**- 0,34**** (-3,00)	23,51%
Retail	1170	**+ 0,50**** (13,89)	**- 0,41**** (-9,85)	**+ 0,21**** (4,18)	35,98%

Table 5.4 – Abnormal earnings equations – Persistence and predictability coefficients

Panel A: $NI_{it}^{a} = \omega_{10} + \omega_{11} NI_{it-1}^{a} + \omega_{12} ACC_{it-1} + \omega_{13} v_{it} + \varepsilon_{1it}$

Industry	*Observ.*	NI_{it-1}^{a} *(t-stat.)*	ACC_{it-1} *(t-stat.)*	v_{it} *(t-stat.)*	$Adj.R^2$
Real Estate Investment and Services	1584	**+ 0,37**** (5,51)	**- 0,06**** (-2,49)	**+ 0,10** (1,44)	15,25%
Services	4215	**+ 0,77**** (25,00)	**- 0,21**** (-8,79)	**- 0,34**** (-9,07)	21,89%
Unclassified	90	**+ 0,21** (0,75)	**- 0,31** (-1,74)	**+ 0,17**** (0,52)	12,69%
Mean	1658	**+ 0,61**** (13,70)	**- 0,22**** (-5,49)	**- 0,11**** (-2,21)	27,59%

Panel B: $NI_{it}^{a} = \omega_{10} + \omega_{11} NI_{it-1}^{a} + \omega_{12} CFO_{it-1} + \omega_{13} v_{it} + \varepsilon_{1it}$

Industry	*Observ.*	NI_{it-1}^{a} *(t-stat.)*	CF_{it-1} *(t-stat.)*	v_{it} *(t-stat.)*	$Adj.R^2$
Mining + Construction	1999	**+ 0,31**** (4,41)	**+ 0,19**** (6,84)	**- 0,07** (1,06)	18,45%
Chemicals	633	**+ 0,39**** (4,81)	**+ 0,17**** (2,71)	**+ 0,02** (0,29)	29,81%
Food and Kindred Products	419	**+ 0,67**** (8,15)	**+ 0,15**** (3,11)	**- 0,33**** (-4,41)	44,88%
Pharmaceuticals	349	**+ 0,72**** (8,28)	**+ 0,18**** (2,48)	**- 0,36**** (-5,22)	58,07%
Manufacturers	3752	**+ 0,48**** (12,20)	**+ 0,19**** (9,70)	**- 0,18**** (-4,81)	22,11%
Utilities	2493	**+ 0,51**** (11,16)	**+ 0,16**** (5,03)	**- 0,13**** (-3,18)	26,16%
Computers, Electronic, Software and Technology	2851	**+ 0,27**** (5,50)	**+ 0,33**** (9,74)	**- 0,05** (1,25)	20,80%
Industrial Transportation	345	**+ 0,64**** (6,07)	**+ 0,08**** (2,09)	**- 0,32**** (-2,87)	23,78%
Retail	1170	**+ 0,09**** (2,82)	**+ 0,39**** (9,59)	**+ 0,23**** (4,58)	35,76%
Real Estate Investment and Services	1584	**+ 0,32**** (4,39)	**+ 0,01** (0,34)	**+ 0,12** (1,68)	15,19%
Services	4215	**+ 0,54**** (13,40)	**+ 0,22**** (9,25)	**- 0,32**** (-8,56)	22,12%

Panel B: $NI_{it}^{a} = \omega_{10} + \omega_{11} NI_{it-1}^{a} + \omega_{12} CFO_{it-1} + \omega_{13} v_{it} + \varepsilon_{1it}$					
Industry	***Observ.***	NI_{it-1}^{a} *(t-stat.)*	CF_{it-1} *(t-stat.)*	v_{it} *(t-stat.)*	$Adj.R^2$
Unclassified	90	**- 0,15** (-0,40)	**+ 0,30** (1,66)	**+ 0,27** (0,77)	12,48%
Mean	1658	**+ 0,39**** (6,65)	**+ 0,20**** (5,21)	**- 0,09**** (-2,00)	27,47%

Notes: *** statistic significance for level of 1%.
** statistic significance for level of 5%.
* statistic significance for level of 10%.

The findings relating to cash flows in the above table 5.4, panel B, reveal that, as predicted, cash flows are significantly incrementally informative regarding future abnormal earnings for almost all twelve industries. The findings also reveal that the sign of ω_{12} for cash flows is opposite of that for accruals, it is significantly positive for all industries, suggesting that the higher the proportion of current earnings attributable to cash flows, the higher future abnormal earnings will be. As with accruals, the ω_{12} estimates (*t*-statistics) varies across industries from 0,07 to 0,41 (2,09 to 9,59), and the industries with the most extreme coefficients are Retail and Computers, Electronic, Software and Technology.

Panel B also reveals that the mean estimated persistence of abnormal earnings, ω_{11}, is 0,39, which is lower than the mean relating to the accruals equation. As with the accruals equation, there is substantial cross-industry variation in estimates of ω_{11}, 0,09 to 0,72. As in accrual system, there is a inter-industry variation on the coefficient of other information, ω_{13}. In Mining and Construction, Chemicals, Computers, Electronic, Software, Technology and Real Estate Investment, this coefficient is not statistical significant, exactly like in panel A, which means that other information does not seem to have impact in forecasting abnormal earnings in these industries. The coefficient on other information, ω_{13}, is positive and significant for only Retail industry which means that other information could be positively significant in determining future abnormal earnings in this industry and for all other industries the coefficient is negative and significant, suggesting that could negatively influence the determination of future abnormal earnings.

Considering the definition of net income, that it is equals accruals plus cash flows, and to the findings in the above table 5.4, we observe that the findings relating to accruals and cash flows in abnormal earnings equations, equations [5.1a] and equation [5.2a] respectively, are "mirror images" of each other. However, equations [5.1a] and [5.2a] are not econometrically equivalent because each equation contains abnormal earnings not net income. This is also the case for equations [5.1c] and [5.2c]. In the next figure, figure 6, we report in a cartesian axis the values of ω_{11} and ω_{12} for cash flows system and for accruals system and we can observe the "mirror image" for all industries.

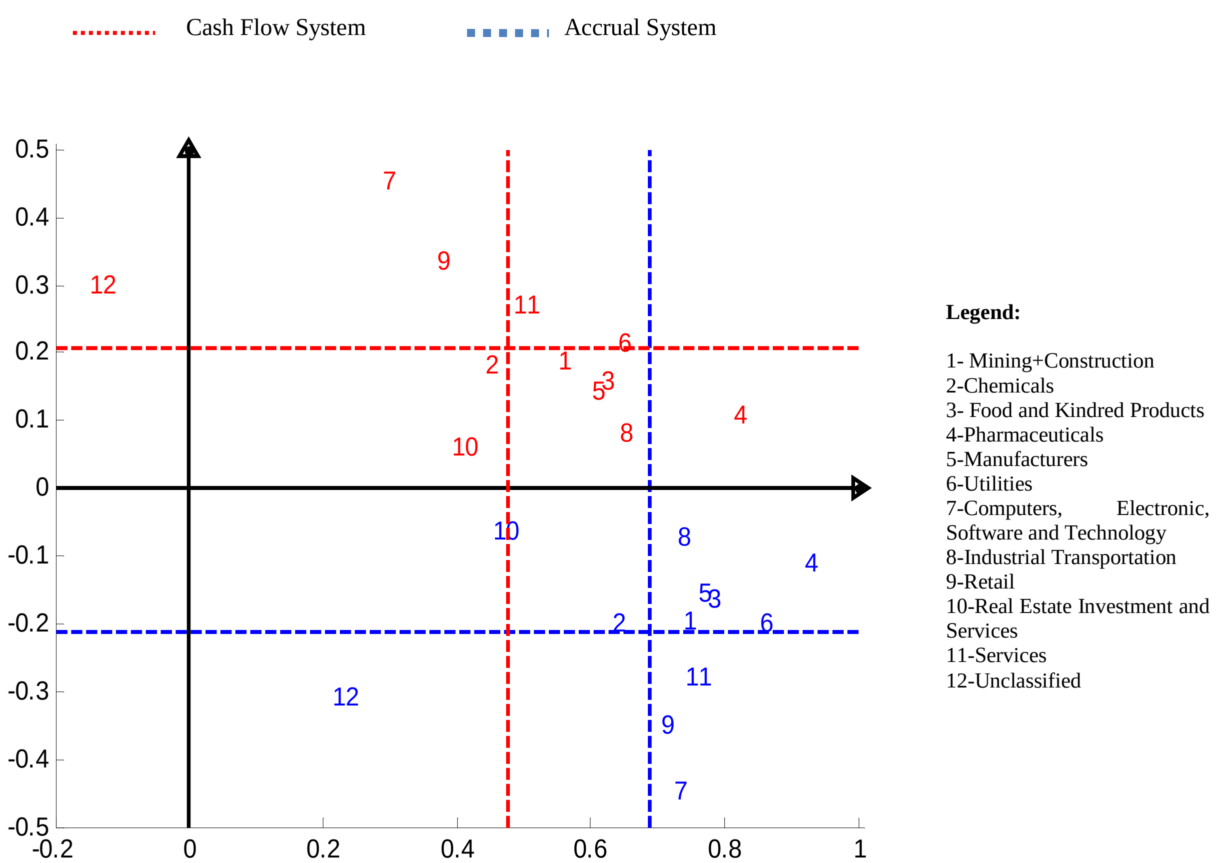


Figure 6: Mirror images between accruals and cash flows

5.4.2. Accruals and cash flows autoregression results

The table 5.5 below presents regression summary statistics corresponding to the earnings component autoregression equation [5.1b] and [5.2b]. The accruals autoregressions reveal that γ_{22} is less than 1,00 in all industries, ranging from 0,08 for Manufacturers to 0,59 for Food and Kindred Products, indicating stationary autoregressive processes for accruals in all industries.

Table 5.5 – Accruals and cash-flows autoregression

Industry	$ACC_{it} = \gamma_{20} + \gamma_{22} ACC_{it-1} + \varepsilon_{2it}$			$CFO_{it} = \gamma_{20} + \gamma_{22} CFO_{it-1} + \varepsilon_{2it}$		
	Observ.	ACC_{it-1} (t-stat.)	$Adj.R^2$	**Observ.**	CFO_{it-1} (t-stat.)	$Adj.R^2$
Mining + Construction	2308	**- 0,02** (-0,72)	1%	2749	**+ 0,59**** (40,24)	37,07%
Chemicals	731	**+ 0,39**** (10,73)	13,59%	834	**+ 0,59**** (24,60)	42,06%
Food and Kindred Products	494	**+ 0,59**** (15,93)	33,93%	544	**+ 0,78**** (33,64)	67,53%
Pharmaceuticals	428	**+ 0,14**** (3,02)	2,08%	798	**+ 0,63**** (23,51)	40,92%
Manufacturers	4359	**+ 0,08**** (4,98)	0,57%	5037	**+ 0,71**** (68,57)	48,28%
Utilities	2965	**+ 0,12**** (6,37)	1,35%	3387	**+ 0,38**** (24,03)	14,57%
Computers, Electronic, Software and Technology	3500	**+ 0,22**** (14,33)	5,54%	4641	**+ 0,46**** (34,64)	20,55%
Industrial Transportation	409	**+ 0,31**** (6,62)	9,67%	572	**+ 0,40**** (10,84)	17,04%
Retail	1384	**+ 0,19**** (6,99)	3,41%	1639	**+ 0,63**** (39,38)	48,62%
Real Estate Investment and Services	1861	**+ 0,36**** (14,86)	10,61%	2255	**+ 0,18**** (8,36)	3,01%
Services	5042	**+ 0,22**** (16,04)	4,86%	6946	**+ 0,48**** (53,55)	29,22%
Unclassified	111	**+ 0,13** (1,30)	1,51%	111	**+ 0,53**** (6,10)	25,13%

Table 5.5 – Accruals and cash-flows autoregression

Industry	$ACC_{it} = \gamma_{20} + \gamma_{22} ACC_{it-1} + \varepsilon_{2it}$			$CFO_{it} = \gamma_{20} + \gamma_{22} CFO_{it-1} + \varepsilon_{2it}$		
	Observ.	ACC_{it-1} *(t-stat.)*	$Adj.R^2$	***Observ.***	CFO_{it-1} *(t-stat.)*	$Adj.R^2$
Mean	1966	**+ 0,23**** (8,37)	7,26%	2459	**+ 0,53**** (30,62)	32,83%

Notes: *** statistic significance for level of 1%.
** statistic significance for level of 5%.
* statistic significance for level of 10%.

The cash flows autoregressions indicate that γ_{22} ranges from 0,18 for Real Estate Investment and Services to 0,78 for Food and Kindred Products. For all industries, γ_{22} is less than 1,00, indicating, as with accruals, that the cash flows autoregressive process is generally stationary. Comparison of the autoregressive parameter estimates across industries shows that accruals are less persistent than cash flows for all industries, except to Real Estate Investment and Services in which the autoregressive parameter estimate for accruals is greater than autoregressive parameter estimate for cash flows (0.36 > 0,18).

5.4.3. Valuation equations

Table 5.6, panel A and B, presents regression summary statistics for the market value added equations, corresponding to the valuation equations [5.1c] and [5.2c].

Panel A reveals that β_2, the coefficient on accruals, is significantly different from zero in almost all industries, as predicted, and it is not statistical significant for Pharmaceuticals and Real Estate Investment and Services. This indicates that the accrual component of earnings is incrementally valuation relevant, which means that the coefficient on accruals differs from that on abnormal earnings. The extreme and statistical significant values for β_2 estimate (*t*-statistics) ranges from -1,33 to -4,08 (-

2,78 to -9,28). The coefficient (*t*-statistics) on abnormal earnigs is significantly positive in almost all industries and ranges from 2,01 to 5,83 (7,70 to 8,48).

Table 5.6 – Valuation equations – Informativeness coefficients

Panel A: $\underbrace{(MVE_{it} - BV_{it})}_{Dif_{MBV}} = \beta_0 + \beta_1 NI^a_{it} + \beta_2 ACC_{it} + \beta_3 v_{it} + \mu_{it}$

Industry	*Observ.*	NI^a_{it} (t-stat.)	ACC_{it} (t-stat.)	v_{it} (t-stat.)	$Adj.R^2$
Mining + Construction	1072	**+ 2,01**** (7,70)	**- 2,45**** (-7,78)	**+ 0,51** (1,88)	8,58%
Chemicals	449	**+ 2,66**** (7,20)	**- 1,33**** (-2,78)	**- 0,05** (-0,15)	11,91%
Food and Kindred Products	187	**+ 5,83**** (8,48)	**- 3,88**** (-4,99)	**+ 0,83** (0,97)	34,72%
Pharmaceuticals	133	**- 1,05** (-0,96)	**- 1,04** (-0,69)	**- 0,04** (-0,05)	4,76%
Manufacturers	2363	**+ 4,80**** (22,11)	**- 1,99**** (-8,55)	**+ 0,99**** (4,20)	21,75%
Utilities	1107	**+ 3,95**** (12,02)	**- 4,08**** (-9,28)	**+ 0,28** (0,81)	14,13%
Computers, Electronic, Software and Technology	1088	**+ 4,97**** (12,95)	**- 3,85**** (-7,46)	**+ 0,59** (1,58)	15,60%
Industrial Transportation	204	**+ 2,98**** (7,64)	**- 1,42**** (-3,65)	**+ 0,66** (1,67)	26,29%
Retail	717	**+ 4,68**** (16,03)	**- 3,52**** (-9,37)	**- 0,25** (-0,79)	29,64%
Real Estate Investment and Services	797	**- 0,15** (-0,47)	**+ 0,33** (0,92)	**- 0,02** (-0,07)	0,12%
Services	2193	**+ 2,50**** (9,92)	**- 2,07**** (-6,67)	**+ 0,67**** (3,01)	5,65%
Unclassified	17	**- 0,16** (-0,08)	**+ 0,46** (0,21)	**+ 1,06**** (2,33)	34,38%
Mean	861	**+ 2,75**** (8,55)	**- 2,07**** (-5,01)	**+ 0,44** (1,28)	17,29%

Panel B: $\underbrace{(MVE_{it} - BV_{it})}_{Dif_{MBV}} = \beta_0 + \beta_1 NI^a_{it} + \beta_2 CFO_{it} + \beta_3 v_{it} + \mu_{it}$

Industry	*Observ.*	NI^a_{it} (t-stat.)	CFO_{it} (t-stat.)	v_{it} (t-stat.)	$Adj.R^2$
Mining + Construction	1072	**+ 0,01** (0,05)	**+ 1,84**** (6,21)	**+ 0,49** (1,78)	6,78%

Panel B: $\underbrace{(MVE_{it} - BV_{it})}_{Dif_{MBV}} = \beta_0 + \beta_1 NI^a_{it} + \beta_2 CFO_{it} + \beta_3 v_{it} + \mu_{it}$

Industry	Observ.	NI^a_{it} (t-stat.)	CFO_{it} (t-stat.)	v_{it} (t-stat.)	$Adj.R^2$
Chemicals	449	**+ 1,57**** (3,69)	**+ 0,95**** (2,09)	**+ 0,01** (0,01)	11,27%
Food and Kindred Products	187	**+ 2,56**** (2,82)	**+ 3,02**** (3,94)	**+ 1,06** (1,21)	31,88%
Pharmaceuticals	133	**- 1,09** (-1,19)	**- 1,28** (-0,89)	**+ 0,39** (0,48)	5,02%
Manufacturers	2363	**+ 2,91**** (11,69)	**+ 1,91**** (8,25)	**+ 0,98**** (4,14)	21,60%
Utilities	1107	**+ 0,71*** (1,98)	**+ 2,71**** (6,45)	**+ 0,39** (1,12)	10,82%
Computers, Electronic, Software and Technology	1088	**+ 1,97**** (4,69)	**+ 2,46**** (4,72)	**+ 1,22**** (3,24)	13,73%
Industrial Transportation	204	**+ 1,71**** (4,49)	**+ 1,47**** (3,97)	**+ 0,49** (1,22)	27,05%
Retail	717	**+ 1,29**** (3,68)	**+ 3,49**** (9,57)	**- 0,29** (-0,90)	29,96%
Real Estate Investment and Services	797	**+ 0,16** (0,65)	**- 0,39** (-1,16)	**+ 0,04** (0,13)	0,18%
Services	2193	**+ 0,63**** (2,53)	**+ 1,81**** (5,98)	**+ 0,68**** (3,09)	5,32%
Unclassified	17	**+ 0,27** (0,65)	**- 0,52** (-0,27)	**+ 1,05**** (2,32)	33,70%
Mean	861	**+ 1,06**** (2,98)	**+ 1,46**** (4,07)	**+ 0,54** (1,49)	16,44%

Notes: *** statistic significance for level of 1%.
** statistic significance for level of 5%.
* statistic significance for level of 10%.

Considering the valuation equations for cash flows, the findings in table 5.6, panel B, also reveal that, as predicted, β_2 is positive and significantly different from zero in all industries, except Pharmaceuticals and Real Estate Investment and Services. This indicates that the cash flow component of earnings is incrementally valuation relevant, which means that the coefficient on cash flows differs from that on abnormal earnings. As with ω_{12} in the abnormal earnings equation, the reversal of signs of β_2 between accruals and cash flows in the valuation equations is consistent with accruals and cash flows being mirror images of each other. As in panel A, the coefficient (*t*-statistics) on abnormal earnings is significantly positive in almost all industries and ranges from 0,63 to 2,91 (2,53 to 11,69).

Similarly with the findings of table 5.4, panel A and panel B, the coefficient on other information, β_3, varies substantially across industries. In Manufacturers and Services, the coefficient on other information, β_3, is positive and statistical significant indicating that other information could be significant in determining future abnormal earnings in these industries. For other industries the coefficient is not statistical significant, which means that other information does not seem to have impact in forecasting abnormal earnings.

5.4.4. High earnings quality versus low earnings quality portfolios

After to estimate the accrual system model and the cash flow system model, we divide the estimated coefficients ω_{11}, ω_{12}, β_1 and β_2 into three classes: high, medium and low earnings quality. And we also divide the adjusted R^2 from equations [5.1c] and [5.2c] into two classes: high and low earnings quality. In appendix 10, tables A.1, A.2 and A.3 report these results and considering them, and in order to capture the two main portfolios, industries with high earnings quality and industries with low earnings quality, we synthesize in the next table 5.7, panel A and panel B, the results obtained.

We consider an industry of high earnings quality if it has at least two scores of "high earnings quality" into the two models (accruals system model and cash flow system model) and it is considered of low earnings quality if it has at least two scores of "low earnings quality". We consider an inconsistent result in terms of earnings quality if an industry has different scores or extreme scores (high and low) in the persistence and predictability coefficients, informativeness coefficients and adjusted R^2.

Table 5.7 – Portfolios of industries: high, medium and low earnings quality

Panel A: Accrual system model				
Industry	**Earnings Quality**			
	Persistence and Predictability (ω_{11} and ω_{12})	Informativeness (β_1 and β_2)	Adjusted R^2	**Conclusion**
Mining+Construction	Low	Medium	Low	**Low**
Chemicals	Medium	Medium	Low	**Medium**
Food and Kindred Products	High	Medium	High	**High**
Pharmaceuticals	High	Low	Low	**Inconsistent**
Manufacturers	High	High	High	**High**
Utilities	High	Medium	Low	**Inconsistent**
Computers, Electronic, Software and Technology	Low	Medium	Low	**Low**
Industrial Transportation	High	High	High	**High**
Retail	Low	Medium	High	**Inconsistent**
Real Estate Investment and Services	Medium	Low	Low	**Low**
Services	High	Medium	Low	**Inconsistent**
Unclassified	Low	Low	High	**Inconsistent**

Panel B: Cash flow system model				
Industry	**Earnings Quality**			
	Persistence and Predictability (ω_{11} and ω_{12})	Informativeness (β_1 and β_2)	Adjusted R^2	**Conclusion**
Mining+Construction	Low	Medium	Low	**Low**
Chemicals	Medium	Medium	Low	**Medium**
Food and Kindred Products	Medium	High	High	**High**
Pharmaceuticals	Medium	Low	Low	**Low**
Manufacturers	Medium	High	High	**High**
Utilities	Medium	Medium	Low	**Medium**
Computers, Electronic, Software and Technology	Medium	High	Low	**Inconsistent**
Industrial Transportation	Medium	High	High	**High**
Retail	Medium	High	High	**High**
Real Estate Investment and Services	Medium	Low	Low	**Low**
Services	High	Medium	Low	**Inconsistent**

Panel B: Cash flow system model				
Industry	**Earnings Quality**			
	Persistence and Predictability (ω_{11} and ω_{12})	Informativeness (β_1 and β_2)	Adjusted R^2	**Conclusion**
Unclassified	Low	Low	High	**Inconsistent**

Crossing the results of panel A and panel B, in the above table 5.7, we categorize the industries of Food and Kindred Products, Manufacturers and Industrial Transportation into the portfolio of high earnings quality because these industries have at least two scores of "high earnings quality" into the two models, accruals system model and cash flow system model. These industries usually have high persistence of abnormal earnings (ω_{11}), low predictability of accruals (ω_{12}), high predictability of cash flows (ω_{12}), high informativeness coefficients (β_1 and β_2) and high explanatory power of earnings to explain market value added, that means, high adjusted R^2 from equations [5.1c] and [5.2c].

We consider Mining and Construction and Real Estate Investment and Services into the portfolio of low earnings quality. In the opposite sense, these industries usually have low persistence of abnormal earnings (ω_{11}), high predictability of accruals (ω_{12}), low predictability of cash flows (ω_{12}), low informativeness coefficients (β_1 and β_2) and low adjusted R^2 from equations [5.1c] and [5.2c].

The results of the other industries are considered inconsistent because it is not possible to define a common pattern between them into the two systems, accrual system and cash flow system, simultaneously.

In order to ascertain our hypotheses regarding high earnings quality versus low earnings quality, we build two sub-samples with the observations of the two main portfolios, industries with high earnings quality and industries with low earnings quality, then we re-estimate the accrual system model (table 5.7) and the cash flow system model (table 5.8) separately for each portfolio over the sample period (1990-2009) and we perform a test robustness, tests of significant differences, for the estimated coefficients ω_{11}, ω_{12}, β_1 and β_2 and adjusted R^2 from equations [5.1c] and [5.2c].

Table 5.8 presents descriptive statistics of different variables for each main portfolio, industries with high earnings quality and industries with low earnings quality. For brevity, we report only the mean and median of all input variables of the models.

Table 5.8 – Descriptive statistics for high earnings quality and low earnings quality portfolios

	Variable	**High Earnings Quality**		**Low Earnings Quality**	
		Mean	**Median**	**Mean**	**Median**
Input Variables of the Models (Relative values)	$\frac{MVE_{it}}{TA_{it}}$	75,07%	57,66%	63,99%	50,83%
	$\frac{BVE_{it}}{TA_{it}}$	42,24%	39,57%	47,07%	45,11%
	$\frac{ACC_{it}}{TA_{it}}$	- 5,01%	- 4,30%	- 2,68%	- 2,37%
	$\frac{NI^a_{it}}{TA_{it}}$	1,27%	1,62%	0,18%	0,80%
	$\frac{CFO_{it}}{TA_{it}}$	7,34%	8,13%	4,01%	4,47%

Mean and median values differ across earnings quality portfolios. Industries in the high earnings quality portfolios usually have higher values of $\frac{MVE_{it}}{TA_{it}}$, $\frac{NI^a_{it}}{TA_{it}}$ and $\frac{CFO_{it}}{TA_{it}}$, and lower $\frac{BVE_{it}}{TA_{it}}$ and $\frac{ACC_{it}}{TA_{it}}$ compared to industries in the low earnings quality portfolios. For example, the mean of the $\frac{MVE_{it}}{TA_{it}}$, $\frac{NI^a_{it}}{TA_{it}}$ and $\frac{CFO_{it}}{TA_{it}}$ in the high (low) earnings quality portfolio are respectively 75,07%, 1,27% and 7,34% (63,99%, 0,18% and 4,01%).

The following table 5.9 and table 5.10 report coefficients, t-statistics, adjusted R^2 and the results of the tests of differences from regressions in all two approaches, accruals system and cash flows sytem, for both portfolios, high quality portfolio and low quality portfolio.

Table 5.9 – High earnings quality versus low earnings quality – Accruals system

		High Quality (HQ) Portfolio			**Low Quality (LQ) Portfolio**		
Variable	**Pred.Sign**	**Equation [5.1a]** Coef. (t-stat.)	**Equation [5.1b]** Coef. (t-stat.)	**Equation [5.1c]** Coef. (t-stat.)	**Equation [5.1a]** Coef. (t-stat.)	**Equation [5.1b]** Coef. (t-stat.)	**Equation [5.1c]** Coef. (t-stat.)
Observ.		4.458	5.262	2.003	3.490	4.169	1.120
$\omega_{11} NI^{a}_{it-1}$	+	**+ 0,336***** (10,25)			**+ 0,297***** (7,03)		
$\omega_{12} ACC_{it-1}$	-	**- 0,119***** (-6,51)	**+ 0,084***** (6,08)		**- 0,089***** (-3,21)	**+ 0,044**** (2,356)	
$\gamma_{22} ACC_{it-1}$	+						
$\beta_1 NI^{a}_{it}$	+			**+ 4,106***** (15,28)			**+ 0,8591**** (2,466)
$\beta_2 ACC_{it}$	-			**- 2,665***** (-8,07)			**- 1,1137***** (-3,424)
v_{it}	+/-	**- 0,049** (-1,51)		**+ 0,589***** (2,72)	**+ 0,111***** (2,68)		**+ 0,7522*** (1,961)
Adjusted R^2		35,56%	0,68%	59,24%	25,65%	12,36%	1,34%
White test		Chi2(9) = 110,762 ***p-value*** = 0,000	Chi2(9) = 7,607 ***p-value*** = 0,022	Chi2(9)=439,302 ***p-value*** = 0,000	Chi2(9) = 239,282 ***p-value*** = 0,000	Chi2(9) = 47,746 ***p-value*** = 0,000	Chi2(9)=191,008 ***p-value*** = 0,000
Test F		F(357, 4097)=2,455 ***p-value*** = 0,000	F(365, 4895)=1,148 ***p-value*** = 0,032	F(153, 1846)=11,8293 ***p-value*** = 0,000	F(283, 3203)=1,515 ***p-value*** = 0,000	F(288, 3879)=2,7873 ***p-value*** = 0,0000	F(98, 1018)=2,635 ***p-value*** = 0,000
Breuch-Pagan		Chi2(1) = 16,697 ***p-value*** = 0,000	Chi2(1) = 8,558 ***p-value*** = 0,003	Chi2(1) = 3036,68 ***p-value*** = 0,000	Chi2(1) =0,027 ***p-value*** = 0,869	Chi2(1) = 156,852 ***p-value*** = 0,0000	Chi2(1) = 107,12 ***p-value*** = 0,000
Test Hausman		Chi2(3) = 738,25 ***p-value*** = 0,000	Chi2(1) = 441,54 ***p-value*** = 0,000	Chi2(3) = 15,3338 ***p-value*** = 0,000	Chi2(1) = 319,776 ***p-value*** = 0,000	Chi2(3) = 111,035 ***p-value*** = 0,0000	Chi2(6) = 15,33 ***p-value*** = 0,000
Estimation method		Fixed Effects	Fixed Effects	Fixed Effects	Fixed Effects	Fixed Effects	Fixed Effects

Table 5.9 – High earnings quality versus low earnings quality – Accruals system

Tests of differences		
Tests	**Test statistic**	**P-value**
$\omega_{11HQ\ Portfolio} > \omega_{11LQ\ Portfolio}$	1,942	0,0522*
$\omega_{12HQ\ Portfolio} < \omega_{12LQ\ Portfolio}$	-1,913	0,0558*
$\beta_{1HQ\ Portfolio} > \beta_{1LQ\ Portfolio}$	12,14	0,0000***
$\beta_{2HQ\ Portfolio} < \beta_{2LQ\ Portfolio}$	-0,733	0,4637
$Adj.R^2_{Equation\,[4.1c]-HQ\ Portfolio} > Adj.R^2$	11,397	0,0000***

Accrual system model comprises the follow equations:

Equation [5.1a]: $NI^a_{it} = \omega_{10} + \omega_{11} NI^a_{it-1} + \omega_{12} ACC_{it-1} + \omega_{13} v_{it} + \varepsilon_{1it}$

Equation [5.1b]: $ACC_{it} = \gamma_{20} + \gamma_{22} ACC_{it-1} + \varepsilon_{2it}$

Equation [5.1c]: $\underbrace{(MVE_{it} - BV_{it})}_{Dif_{MBV}} = \beta_0 + \beta_1 NI^a_{it} + \beta_2 ACC_{it} + \beta_3 v_{it} + \mu_{it}$

Notes:

NI^a_{it} is abnormal earnings, defined as earnings minus the normal return on equity book value (BVE_{it} is the common equity, WS 03501), $NI^a_{it} = NI_{it} - r \times BVE_{it-1}$, where r is a discount rate, which is an intertemporal constant rate. The earnings variable is calculated as net income before extraordinary items/preferred dividends (NI_{it}, WS 01551). ACC_{it} is total accruals, defined as earnings (NI_{it} ,WS 01551) minus cash flows from operations (CFO_{it}, WS 04201). MVE_{it} is the market value equity (WS 08001). Dif_{MBV} is the market value added ($Dif_{MBV} = MVE_{it} - BV_{it}$), that means, the difference between the current market and book values of common equity. v_{it} is the *other information*. ε_{1it} and μ_{it} are the random disturbance term and $i = 1,...,N\ Firms$ and $t = 1,...,T\ Period$. All variables are sacled by total assets (TA_{it}, WS 02999).

*** statistic significance for level of 1%.
** statistic significance for level of 5%.
* statistic significance for level of 10%.

Performing *F*, *Breusch-Pagan* and *Hausman* tests we conclude that fixed effects model improves our results. Performing White test, we reject the null hypothesis with a *p-value* = 0.000 and consequently we emphasized the heteroscedasticity, using a fixed effects model we take into account the individual heterogeneity, as performed in the previous chapter.

The persistence coefficients of the contemporaneous abnormal earnings on future abnormal earnings, ω_{11} is always significantly positive for both portfolios, which is consistent with the findings in the previous chapter (chapter 4) and with prior research (Barth *et al.*, 1999 and 2005; Dechow *et al.*, 1999; Hand and Landsman, 1999). The coefficient estimate (*t*-statistics) is respectively 0.336 (10.25) for the high quality portfolio, which is consistently higher compared to 0.297 (7.03) for the low quality portfolio.

The ω_{12} coefficient of the equation [5.1a], the predictability coefficient of total accruals on abnormal earnings equation is significantly negative for both portfolios, suggesting that the lower the proportion of current earnings attributable to accruals, the higher future abnormal earnings will be. The coefficient estimate (*t*-statistics) is respectively -0,119 (-6,51) for the high quality portfolio and -0.089 (-3.21) for the low quality portfolio.

The coefficient on other information, ω_{13} from equation [5.1a] is positive and statistical significant for the low quality portfolio, indicating that other information could be significant in determining future abnormal earnings in this kind of portfolio but it is not statistical significant for the high quality portfolio. The coefficient estimate (*t*-statistics) is respectively -0,049 (-1,51) for the high quality portfolio and 0.111 (2.68) for the low quality portfolio.

The accruals autoregressions reveal that γ_{22} is significantly positive and less than 1.00 indicating stationary autoregressive processes for accruals in both portfolios, which is consistent with the findings in the previous chapter (chapter 4) and with prior research. The coefficient (*t*-statistics) estimates, γ_{22}, is respectively 0,084 (6,08) for the high quality portfolio and 0.044 (2.37) for the low quality portfolio. For the two portfolios considered the coefficient estimates is close to zero, so, we can conclude that total accruals are practically a transitory earnings component in high quality portfolio and in low quality portfolio.

The valuation coefficients on abnormal earnings, β_1, is significantly positive for both portfolios. The coefficient estimate (*t*-statistics) is respectively 4.106 (15.28) for the high quality portfolio, which is consistently higher compared to 0.859 (2.47) for the low quality portfolio.

The incremental valuation coefficient of total accruals, β_2, is significantly negative for both portfolios. The coefficient estimate (*t*-statistics) is respectively -2.665 (-8.07) for the high quality portfolio and -1.114 (-3.42) for the low quality portfolio. These findings are consistent with our previous predictions, once that, the sign of ω_{12} seems to determine the sign of β_2. The higher predictive ability of the component for future abnormal earnings, the larger, in absolute value, will be β_2. Second, the higher is the persistence parameter, γ_{22}, the higher is β_2. And third, β_2 is similarly dependent on the persistence of abnormal earnings, ω_{11}, that is, the higher the persistence of abnormal earnings, the higher is β_2 and the bigger ω_{11} is, the bigger β_1 will be.

In fact, the persistence coefficients of the contemporaneous abnormal earnings on future abnormal earnings, measured by ω_{11}, the predictive ability of the accruals component, measured by ω_{12}, and the persistence parameter of total accruals, measured by γ_{22}, they seem to be higher for high quality portfolio than to low quality portfolio, so, consequently, the valuation coefficients on abnormal earnings, β_1, and the incremental valuation coefficient of total accruals, β_2, are significantly higher for high quality portfolio than to low quality portfolio. This positive relation between persistence and value relevance is consistent with predictions made and tested in prior research, for example, Lipe (1986), Kormendi and Lipe (1987), Barth *et al.* (1990, 1992, 1999 and 2005).

We conduct a univariate test of differences in the persistence coefficients of the contemporaneous abnormal earnings on future abnormal earnings (ω_{11}), in the predictive ability of the accruals component (ω_{12}), in the valuation coefficients on abnormal earnings (β_1) and in the incremental valuation coefficient of total accruals (β_2) between both portfolios and the results are report in the above table 5.9.

The test results indicate that the persistence coefficient of the contemporaneous abnormal earnings on future abnormal earnings (ω_{11}) in the high quality portfolio is significantly (*t*-stat = 1.942, 0.05 < *p-value* < 0.10) higher than the persistence coefficients in the low quality portfolio for a statistic significance level of 10%. The predictive ability of the accruals component (ω_{12}) in the high quality portfolio is significantly (*t*-stat = -1.913, 0.05 < *p-value* < 0.10) lower than the predictability coefficient in the low quality portfolio for a statistic significance level of 10%. The valuation coefficient on abnormal earnings (β_1) in the high quality portfolio is significantly (*t*-stat = 12.14, *p-value* < 0.05) higher than valuation coefficient on abnormal earnings in the low quality portfolio for a statistic significance level of 1%. Finally, we could not find a difference statistically significant in relation to the incremental valuation coefficient of total accruals (β_2) between both portfolios. However, these findings support our hypothesis **H_{1a},** which states that "informativeness of earnings (β *coefficients*) is significantly higher in portfolios of industries with high earnings quality (high persistence of abnormal earnings and low predictability of accruals) compared to industries with low earnings quality (low persistence of abnormal earnings and high predictability of accruals)".

Table 5.9 also presents explanatory power (adjusted R^2) for each estimation. Adjusted R^2 from equation [5.1a] and from equation [5.1c] are respectively 35,56% and 59,24% for the high quality portfolio compared to 25,65% and 1,34% for the low quality portfolio. A univariate *t*-test of differences in adjusted R^2 between the two portfolios shows that the explanatory power in the high quality portfolio is significantly (*t*-stat = 11.397, *p-value* < 0.05) higher than the explanatory power in the low quality portfolio. These findings support our hypothesis **H_{1b}**, which states that "explanatory power of earnings (adjusted R^2) to explain market value added is significantly higher in portfolios of industries with high earnings quality (high persistence of abnormal earnings and low predictability of accruals) compared to industries with low earnings quality (low persistence of abnormal earnings and high predictability of accruals)”.

In the following table 5.10, we report the results of the cash flows sytem approach, for both portfolios, high quality earnings portfolio and low quality earnings portfolio.

Table 5.10 – High quality versus low quality earnings – Cash-flows system

		High Quality (HQ) Portfolio			Low Quality (LQ) Portfolio		
Variable	**Pred.Sign**	**Equation [5.2a]** Coef. (t-stat.)	**Equation [5.2b]** Coef. (t-stat.)	**Equation [5.2c]** Coef. (t-stat.)	**Equation [5.2a]** Coef. (t-stat.)	**Equation [5.2b]** Coef. (t-stat.)	**Equation [5.2c]** Coef. (t-stat.)
Observ.		4.458	6.153	2.003	3.490	5.004	1.120
$\omega_{11}NI^{a}_{it-1}$	+	**+ 0,2236***** (6,262)			**+ 0,2105***** (4,76)		
$\omega_{12}CFO_{it-1}$	+	**+ 0,1128***** (6,199)			**+ 0,0875***** (3,19)		
$\gamma_{22}CFO_{it-1}$	+		**+ 0,3567***** (28,02)			**+ 0,1193***** (8,170)	
$\beta_1 NI^{a}_{it}$	+			**+ 1,4878***** (5,77)			**+ 0,2579** (0,74)
$\beta_2 CFO_{it}$	+			**+ 2,6943***** (8,36)			**+ 0,3026** (0,764)
v_{it}	+/-	**- 0,0484** (- 1,456)		**+ 0,5611***** (2,59)	**+ 0,1150***** (2,765)		**+ 0,5661** (1,545)
Adj - R^2		33,51%	54,25%	59,33%	25,65%	21,33%	13,74%
White test		Chi2(9) = 109,564 ***p-value*** = 0,000	Chi2(2) = 812,0805 ***p-value*** = 0,000	Chi2(9)=422,9903 ***p-value*** = 0,000	Chi2(9) = 239,63 ***p-value*** = 0,000	Chi2(2) = 103,84 ***p-value*** = 0,000	Chi2(9)=166,64 ***p-value*** = 0,000
Test F		F(357, 4097)=2,441 ***p-value*** = 0,000	F(445, 5706)=3,593 ***p-value*** = 0,000	F(153, 1846)=11,726 ***p-value*** = 0,000	F(283, 3203)=1,524 ***p-value*** = 0,000	F(364, 4638)=2,6025 ***p-value*** = 0,000	F(98, 1018)=2,4933 ***p-value*** = 0,000
Breuch-Pagan		Chi2(1) = 16,3441 ***p-value*** = 0,000	Chi2(1) = 35,7944 ***p-value*** = 0,000	Chi2(1) = 3034,5 ***p-value*** = 0,000	Chi2(1) = 4461,5 ***p-value*** = 0,9947	Chi2(1) = 87,3114 ***p-value*** = 0,000	Chi2(1) = 91,307 ***p-value*** = 0,000
Test Hausman		Chi2(3) = 732,693 ***p-value*** = 0,000	Chi2(1) = 1131,29 ***p-value*** = 0,000	Chi2(3) = 14,2151 ***p-value*** = 0,0026	Chi2(1) = 321,76 ***p-value*** = 0,000	Chi2(3) = 948,87 ***p-value*** = 0,0000	Chi2(6) = 15,6236 ***p-value*** = 0,0014
Estimation method		Fixed Effects	Fixed Effects	Fixed Effects	Fixed Effects	Fixed Effects	Fixed Effects

Table 5.10 – High quality versus low quality earnings – Cash-flows system

Tests of differences		
Tests	**Test statistic**	**P-value**
$\omega_{11HQ\ Portfolio} > \omega_{11LQ\ Portfolio}$	2,038	0,0416**
$\omega_{12HQ\ Portfolio} > \omega_{12LQ\ Portfolio}$	0,4989	0,6178
$\beta_{1HQ\ Portfolio} > \beta_{1LQ\ Portfolio}$	11,81	0,0000***
$\beta_{2HQ\ Portfolio} > \beta_{2LQ\ Portfolio}$	8,533	0,0000***
$Adj.R^2_{Eq.8c-HQ\ Portfolio} > Adj.R^2_{Eq.8c-L}$	10,6272	0,0000***

Cash flow system model comprises the follow equations:

Equation [5.2a]: $NI^a_{it} = \omega_{10} + \omega_{11} NI^a_{it-1} + \omega_{12} CFO_{it-1} + \omega_{13} v_{it} + \varepsilon_{1it}$

Equation [5.2b]: $CFO_{it} = \gamma_{20} + \gamma_{22} CFO_{it-1} + \varepsilon_{2it}$

Equation [5.2c]: $\underbrace{(MVE_{it} - BVE_{it})}_{Dif_{MBV}} = \beta_0 + \beta_1 NI^a_{it} + \beta_2 CFO_{it} + \beta_3 v_{it} + \mu_{it}$

Notes:

NI^a_{it} is abnormal earnings, defined as earnings minus the normal return on equity book value (BVE_{it} is the common equity, WS 03501), $NI^a_{it} = NI_{it} - r \times BVE_{it-1}$, where r is a discount rate, which is an intertemporal constant rate. The earnings variable is calculated as net income before extraordinary items/preferred dividends (NI_{it}, WS 01551). ACC_{it} is total accruals, defined as earnings (NI_{it} ,WS 01551) minus cash flows from operations (CFO_{it}, WS 04201). MVE_{it} is the market value equity (WS 08001). Dif_{MBV} is the market value added ($Dif_{MBV} = MVE_{it} - BV_{it}$), that means, the difference between the current market and book values of common equity. v_{it} is the *other information*. ε_{1it} and μ_{it} are the random disturbance term and $i = 1,...,N\ Firms$ and $t = 1,...,T\ Period$. All variables are sacled by total assets (TA_{it}, WS 02999).

*** statistic significance for level of 1%.
** statistic significance for level of 5%.
* statistic significance for level of 10%.

Analogous to the interpretation of table 5.9, we can observe the results reported in the above table 5.10 about cash-flow system and after performing *F*, *Breusch-Pagan* and *Hausman* tests we conclude that fixed effects model improves our results. After performing White test, we reject the null hypothesis with a *p-value* = 0.000 and consequently we emphasized the heteroscedasticity, using a fixed effects model we take into account the individual heterogeneity.

The persistence coefficients of the contemporaneous abnormal earnings on future abnormal earnings, ω_{11} is also always significantly positive for both portfolios. The coefficient estimate (*t*-statistics) is respectively 0.2236 (6.26) for the high quality portfolio, which is consistently higher, although similar, compared to 0.210 (4.76) for the low quality portfolio.

The ω_{12} coefficient of the equation [5.1a], the predictability coefficient of total cash flows on abnormal earnings equation is significantly positive for both portfolios, as expected, suggesting that the higher the proportion of current earnings attributable to cash flows, the higher future abnormal earnings will be. The coefficient estimate (*t*-statistics) is respectively 0.1128 (6.199) for the high quality portfolio and 0.0875 (3.19) for the low quality portfolio.

Curiously and as the results reported in table 5.9, on the accrual system approach, the coefficient on other information, ω_{13} from equation [5.1a] is positive and statistical significant for the low quality portfolio, indicating that other information could be significant in determining future abnormal earnings in this kind of portfolio but it is not statistical significant for the high quality portfolio. The coefficient estimate (*t*-statistics) is respectively -0,049 (-1,46) for the high quality portfolio and 0.115 (2.77) for the low quality portfolio.

The cash flows autoregressions reveal that γ_{22} is significantly positive and less than 1.00 indicating stationary autoregressive processes for cash flows in both portfolios. The coefficient (*t*-statistics) estimate, γ_{22}, is respectively 0.357 (28.02) for the high quality portfolio and 0.119 (8.17) for the low quality portfolio.

The valuation coefficients on abnormal earnings, β_1, is significantly positive only for high quality portfolio. The coefficient estimate (*t*-statistics) is respectively 1.488 (5.77) for the high quality portfolio and 0.258 (0.74) for the low quality portfolio.

The incremental valuation coefficient of cash flows, β_2, is also significantly positive only for high quality portfolio. The coefficient estimate (*t*-statistics) is respectively 2.694 (8.36) for the high quality portfolio and 0.303 (0.76) for the low quality portfolio. These findings are consistent with our previous predictions, once that, the persistence coefficients of the contemporaneous abnormal earnings on future abnormal earnings, measured by ω_{11}, the predictive ability of the cash flows component, measured by ω_{12}, and the persistence parameter of cash flows, measured by γ_{22}, seems to be higher for high quality portfolio than to low quality portfolio, so, consequently, the valuation coefficients on abnormal earnings, β_1, and the incremental valuation coefficient of cash flows, β_2, are significantly higher for high quality portfolio.

Analogous to the accrual system approach, we conduct a univariate test of differences in the persistence coefficients of the contemporaneous abnormal earnings on future abnormal earnings (ω_{11}), in the predictive ability of the cash flows component (ω_{12}), in the valuation coefficients on abnormal earnings (β_1) and in the incremental valuation coefficient of cash flows (β_2) between both portfolios and the results are report in the above table 5.10.

The test results indicate that the persistence coefficient of the contemporaneous abnormal earnings on future abnormal earnings (ω_{11}) in the high quality portfolio is significantly (*t*-stat = 2.038, *p-value* < 0.05) higher than the persistence coefficients in the low quality portfolio for a statistic significance level of 5%. We could not find a difference statistically significant in relation to the predictive ability of the cash flows component (ω_{12}). The valuation coefficient on abnormal earnings (β_1) in the high quality portfolio is significantly (*t*-stat = 11.81, *p-value* < 0.05) higher than valuation coefficient on abnormal earnings in the low quality portfolio for a statistical significance level of 1%. Finally, we found a difference statistically significant in relation to the incremental valuation coefficient of total accruals (β_2) between both portfolios. The incremental valuation coefficient of total accruals (β_2) in the high quality portfolio is significantly (*t*-stat = 8.533, *p-value* < 0.05) higher for a statistic significance level of 1%. These findings suppor our hypothesis $\mathbf{H_{2a}}$**,** which states that "informativeness of earnings (β *coefficients*) is significantly higher in portfolios of industries with high earnings quality (high persistence of abnormal earnings and high predictability of cash flows) compared to industries with low earnings quality (low persistence of abnormal earnings and low predictability of cash flows)".

Table 5.10 also presents explanatory power (adjusted R^2) for each estimation. Adjusted R^2 from equation [5.1a] and from equation [5.1c] is respectively 33.51% and 59.33% for the high quality portfolio compared to 25.65% and 13.74% for the low quality portfolio. A univariate *t*-test of differences in adjusted R^2 between the two portfolios shows that the explanatory power in the high quality portfolio is also significantly (*t*-stat = 10.627, *p-value* < 0.05) higher than the explanatory power in the low quality portfolio. These findings support our hypothesis $\mathbf{H_{2b}}$, which states that "explanatory power of earnings (adjusted R^2) to explain market value added is significantly higher in portfolios of industries with high earnings quality (high persistence of abnormal earnings and high predictability of cash flows) compared to industries with low earnings quality (low persistence of abnormal earnings and low predictability of cash flows)".

5.5. Summary and concluding remarks

As predicted, we find, for all industries, that the differential ability of accruals and cash flows components of earnings to help forecast future abnormal earnings and the persistence of the components is due to the fact of the components have different valuation implications.

We base our tests on Ohlson (1999), which extends the Ohlson and Feltham-Ohlson framework (Ohlson, 1995; Feltham and Ohlson, 1995) by modelling earnings components, just as Barth *et al.* (1999), applied to twelve industries. We find that:

- Accruals and cash flows aid in forecasting future abnormal earnings;
- The two components, accruals and cash flows, do not have the same ability to predict future abnormal earnings, in particular, the coefficients on accruals and cash flows are negative and positive, respectively, indicating that abnormal earnings is less persistent when accruals comprise a larger proportion of current earnings, as previously predicted;

– Considering the definition of net income, that it is equals accruals plus cash flows, we observe that the findings relating to accruals and cash flows in abnormal earnings equations are “mirror images” of each other;

– Comparisons of the autoregressive parameter estimates across industries shows that accruals are less persistent than cash flows for almost all industries;

– The interaction between two key characteristics of the components, their ability to aid in forecasting future abnormal earnings (predictability) and the persistence of the components themselves, results in different valuation implications of the accruals and cash flows components of earnings;

– Accruals and cash flows provide explanatory power for maket value added, both components have value relevance in that their estimated total valuation coefficients differ from zero, indicating that they have a significant relation with market value added.

After performing a separate industry estimation according to the system of equations for each earnings components (accruals and cash flows) and building two portfolios with the estimated coefficients, portfolios of industries with high earnings quality and portfolios of industries with low earnings quality we corrobate our hypotheses (H_{1a}-H_{1b}, H_{2a}-H_{2b}):

- Informativeness of earnings is significantly higher in portfolios of industries with high quality earnings (high persistence of abnormal earnings and low (high) predictability of accruals (cash flows)) compared to portfolios of industries with low quality earnings (low persistence of abnormal earnings and high (low) predictability of accruals (cash flows));

- Explanatory power of earnings to explain market value added is significantly higher in portfolios of industries with high quality earnings (high persistence of abnormal earnings and low (high) predictability of accruals (cash flows)) compared to portfolios of industries with low quality earnings (low persistence of abnormal earnings and high (low) predictability of accruals (cash flows)).

Chapter 6

The Multidimensional Nature of the Earnings Quality Concept: A Factor Analysis

6.1. Introduction

As explained in chapter 1, section 1.2, the earnings quality (EQ) concept is complex and nebulous, although the concept is of common use, there is no consensus between academics and practitioners on its content, there is not a unique definition, neither an adequate measure for it – earnings quality concept has a multidimensional nature. Consistent with this broad definition of earnings quality, in chapter 3, we describe the several earnings quality constructs and measures that have been most used in academic accounting research and in teaching and we classify them in three main categories: earnings quality constructs that derive from (1) the time-series properties of earnings; (2) the accruals quality; (3) selected qualitative characteristics in the conceptual framework of IASB/FASB. Appendix 3 summarized all measures and constructs reviewed in chapter 3.

In this chapter our main purpose relies on the development of a measure instrument that allows to delimitate the basic constructs and measures of the earnings quality concept, through the application of exploratory multivariate analysis, namely, factor analysis of principal components. We test empirically whether factor analysis provides a deeper understanding of the relevant dimensions of earnings quality concept.

The purpose of factor analysis is to discover simple patterns in the pattern of relationships among the variables. In particular, it seeks to discover if the observed variables, which are not measured directly, can be explained largely or entirely in terms of a much smaller number of variables called factors. Although the application of factor analysis is not very common in accounting research, a number of studies have applied these techniques (*e.g.*, Dechow *et al.*, 1996; Bushee, 1998; Cohen *et al.*, 2004; Lee, 2004; Barua, 2006).

The chapter is organized as follows: section 6.2 presents the earnings quality measures and the research design, namely, a detailed description of the factor analysis; section 6.3 describes the sample and data, and results of factor analysis (extraction of factors) are discussed in section 6.4. Section 6.5 summarizes and concludes the chapter.

6.2. Earnings quality measures and research design

6.2.1. Earnings quality measures

We design our analysis in two stages:

Stage 1. Allowing us to obtain the basic earnings quality (EQ) measures by using time-series data analysis and some ratios analysis.

Stage 2. Allowing us to obtain a set of main "factors" or "underlying dimensions" of EQ, through the application of factor analysis of principal components. Factor analysis is a data reduction technique to research interdependencies. By factor analysis we mean the study of interrelationships between the variables in an effort to find a new set of variables, fewer in number than the original set of variables, which express what is *common* to the original variables. Thus, whenever we use the term "factor analysis" we are strictly speaking about those techniques that distinguish different types of variance. Similarly, whenever we use the term "factors" or "underlying dimensions" we are referring to factors that only represent common or shared variation.

Highlight that, in stage 1, we developed a large econometric work in order to get the different earnings quality measures importants to aplly the factor analysis in stage 2.

Based on literature review in chapter 3 and appendix 3, in the following table 6.1 we summarized the earnings quality measures to be used in factor analysis. We use twenty earnings quality (EQ) measures - EQ_1 to EQ_{20}. Note that the numbering of the equations presented in the following table 6.1 is consistent with the numbers presented in the previous chapter 3, in which it has been reviewed the relevant literature concerning the earnings quality constructs and measures.

Table 6.1 – Earnings quality measures

Dimension	Analitic Formulation	EQ Measure Identifier
Time series properties of earnings:		
• **Persistence**	Autoregressive model of order one (AR1) for annual earnings: [3.1] $x_{t+1} = \phi_0 + \phi_1 x_t + \varepsilon_t$	• $EQ_1 = \phi_1$
	Pearson correlation between current and next period earnings: [3.4] $x_t = \sigma_1 x_{t+1}$	• $EQ_2 = \sigma_1$
• **Predictability**	Based on Lipe (1990), one measure of earnings predictability is also derived from the firm-year specific AR1 models. Specifically, we use the square root of the error variance from equation [3.1].	• $EQ_3 = \sqrt{\hat{\sigma}^2(\varepsilon_t)}$
	Pearson correlation between current earnings and next period cash flow: [3.5] $x_{it} = \varphi_1 CFO_{it+1}$	• $EQ_4 = \varphi_1$
• **Smoothness**	We define $Smoothness_{it}$ as the ratio of firm j's standard deviation of net income before extraordinary items (x_{it}) divided by beginning assets, to its standard deviation of cash flows from operations (CFO_{it}) divided by beginning total assets.	• $EQ_5 = \dfrac{\sigma(x_{it})}{\sigma(CFO_{it})}$
	The correlation between changes in accruals and changes in cash flows.	• $EQ_6 = Corr(\Delta ACC_{it}, \Delta CFO_{it})$
• **Informativeness of earnings**	[3.7] $RET_{it} = \alpha_0 + EQ_7 EARN_{it} + \varepsilon_{it}$ [3.8] $RET_{it} = \alpha_0 + EQ_8 \Delta EARN_{it} + \varepsilon_{it}$ [3.9] $RET_{it} = \alpha_0 + EQ_9 \dfrac{\Delta EARN_{it}}{EARN_{it}} + \varepsilon_{it}$	The earnings response coefficient indicates the relative change in stock price when earnings-per-share varies a monetary unit: • EQ_7 • EQ_8 • EQ_9
• **Relevance**	Our measure of value relevance $(\mathrm{Re}levance)$ is	• $EQ_{10} = R^2_{i,equation[3.22]}$,

Table 6.1 – Earnings quality measures

Dimension	Analitic Formulation	EQ Measure Identifier
	based on the explained variability from the following regression of returns on the level and change in earnings: [3.22] $RET_{it} = \delta_0 + \delta_1 EARN_{it} + \delta_2 \Delta EARN_{it} + \zeta_{it}$	the explanatory power (R^2) from [3.22], for each firm-year specific regression. • EQ_{11} = $R^2_{j,t,equation[3.7]}$, the adjusted R^2 from equation [3.7]. • EQ_{12} = $R^2_{j,t,equation[3.8]}$, the adjusted R^2 from equation [3.8]. • EQ_{13} = $R^2_{j,t,equation[3.9]}$, the adjusted R^2 from equation [3.9].
• **Timeliness** **Timely loss recognition (TLR)**	Our measure of timeliness is derived from reverse regressions, which use earnings as the dependent variable and returns measures as independent variables: [3.23] $EARN_{it} = \alpha_0 + \alpha_1 NEG_{it} + \beta_1 RET_{it} + \beta_2 NEG_{it} * RET_{it} + \zeta_{j,t}$ Where $NEG_{it} = 1$ if $RET_{it} < 0$ and $NEG_{it} = 0$ otherwise.	• $EQ_{14} = R^2_{j,t,equation[3.23]}$, the adjusted R^2 from [3.23], our measure of timeliness is based on the explanatory power of equation [3.23]. • $EQ_{15} = \beta_1$, there is a demand for timely loss recognition (TLR) to combat management's natural optimism.
• **Conservatism**	Our measure of conservatism is the negative of the ratio of the coefficient on bad news to the coefficient on good news.	• $EQ_{16} = -{(\beta_1 + \beta_2)}/{\beta_1}$ Larger values of Timeliness and Conservatism imply less timely earnings and less conservative earnings, respectively, than do smaller values of these variables.
Accrual Quality:	**Magnitude of accruals:** • EQ_{17}: $ACC_{it} = NI_{it} - CFO_{it}$	Extreme accruals (EQ_{17}) are low quality because they represent a less persistent component of earnings.
	Changes in total accruals: • EQ_{18} = ΔACC_{it}	High values of EQ_{18} imply higher changes in total accruals and provide lower earnings quality.

Table 6.1 – Earnings quality measures

Dimension	Analitic Formulation	EQ Measure Identifier
Metrics based on direct estimation of accruals-to-cash relations (Dechow and Dichev's, 2002):	**Dechow and Dichev 's(2002) model (DD-model):** [3.17] $\frac{TCA_{it}}{Assets_{it}} = \varphi_0 + \varphi_1 \frac{CFO_{it-1}}{Assets_{it}} + \varphi_2 \frac{CFO_{it}}{Assets_{it}} + \varphi_3 \frac{CFO_{it+1}}{Assets_{it}} + \varsigma$	Based on cross-sectional regressions using the DD-model approach two different earnings quality metrics are defined: • EQ_{19} is the absolute value of firm i 's residual in year t, $\lvert\hat{\varsigma}_{it}\rvert$. • EQ_{20} is the standard deviation of the firm-specific residuals, $\sigma(\hat{\varsigma}_{it})$.

x_t is any measure of earnings of the several firms i for the period t, in general, the earnings level is calculated as net income before extraordinary items/preferred dividends (NI_t, WS 01551) scaled by Total Assets (TA_t, WS 02999). CFO_t is cash flows from operations of the several firms i for the period t, is the funds from operations Worldscope item (WS 04201). ACC_t is total accruals, defined as earnings (NI_t) less cash flows from operations (CFO_{it}). $RET_{it} = \frac{P_{it} - P_{it-1}}{P_{it-1}}$ is the firm j's 12-month stock return. P_{it} is the last stock price in the end of fiscal year t (WS 05025). $EARN_{it}$ is the firm i's earnings before extraordinary items in year t, scaled by market value (MVE_{it}) at the end of year $t-1$. $\Delta EARN_{it}$ is the change in firm i's earnings before extraordinary items in year t, scaled by market value (MVE_{it}) at the end of year $t-1$. MVE_{it} is the market value equity (WS 08001). ΔCA_{it} is the firm i 's change in current assets between year $t-1$ and year t (current assets, WS 02201); ΔCL_{it} is the firm i 's change in current liabilities between year $t-1$ and year t (current liabilities, WS 03101); $\Delta CASH_{it}$ is the firm i 's change in cash between year $t-1$ and year t (cash, WS 02005); $\Delta STDEBT_{it}$ is the firm i 's change in short term debt and current portion of long term debt between year $t-1$ and year t (short term debt and current portion of long term debt, WS 03051); DEP_{it} is the firm i 's depreciation and amortization expense in year t (depreciation, depletion and amortization, WS 01151); ς_{it}, ε_{it} *are aleatory disturbance term;* $i = 1,...,N\ Firms$; $t = 1,...,T\ Period$.

We use three set of measurement approaches to obtain our twenty earnings quality (EQ) metrics. The first set of EQ metrics is based on:

– Time-series constructs associated with earnings quality, included persistence (EQ_1 and EQ_2), predictability (EQ_3 and EQ_4) and smoothness (EQ_5 and EQ_6);

– Constructs derived from selected qualitative characteristics in the conceptual framework of IASB/FASB, such as, relevance (EQ_{10}, EQ_{11}, EQ_{12} and EQ_{13}), timeliness (EQ_{14} and EQ_{15}) and conservatism (EQ_{16}).

The second set of EQ metrics is based on informativeness of earnings constructs (EQ_7, EQ_8 and EQ_9). Informativeness is the information content with respect to future earnings. A large body of research demonstrates that accounting numbers and, particularly, earnings have information content. Earnings quality concept in terms of informative content is a way to assess the relevance and reliability of earnings. To analyse the association between earnings - that is accounting information - and the stock prices or market values we may use return or prices models.

And the third set of EQ metrics is based on measures of accruals quality: magnitude of accruals (EQ_{17}), change in total accruals (EQ_{18}) and metrics based on direct estimation of accruals-to-cash relations, where EQ_{19} and EQ_{20} are based on firm-specific time-series regressions of Dechow and Dichev's (2002) model.

Following previous research (*e.g.*, Francis *et al.*, 2004 and 2005; Dechow *et al.*, 2010; Gaio and Raposo, 2011), we defined the first three attributes of the first set (persistence, predictability and smoothness) and all attributes of the third set (accrual quality) as **accounting-based** because these attributes take cash or earnings itself as the reference construct and consequently they are typically measured using accounting information only. We defined the last three attributes of the first set (value relevance, timeliness and conservatism) and the second set (informativeness of earnings) as **market-based** because proxies for these constructs are typically based on relations between market data and accounting data. These attributes take returns or prices as the reference construct, consequently, measures of these attributes are based on the estimated relation between accounting earnings and market prices or returns.

We define the twenty earnings attributes as either **accounting-based** or **market-based** to capture differences in underlying assumptions about the function of earnings, which are, in turn, reflected in the way the attributes are measured.

In the next section, we present a detailed description of the factor analysis.

6.2.2. Factor analysis model

Factor analysis is a statistical technique used to identify a relatively small number of factors ($y_1, y_2, ..., y_p$) that can be used to represent relationships among sets of many interrelated variables ($x_1, x_2, ..., x_p$). The basic assumption of factor analysis is that underlying dimensions, or factors, can be used to explain a complex phenomena. For example, variables such as scores on a battery of aptitude tests may be expressed as a linear combination of factors that represent verbal skills, mathematical aptitude, and perceptual speed. Factor analysis helps identify these underlying, not-directly-observable constructs.

The coefficients (*loadings or weights*) a_{ij}, *with* $i = 1, ..., p$ *and* $j = 1, ..., p$, that define each one of the new variables are chosen in way that the derived variables (principal components) explain the maximum variation in the original data and don't be correlated to each other. The model of the principal components can be written as:

$$[6.1] \quad \begin{cases} y_1 = a_{11}x_1 + a_{12}x_2 + ... + a_{1p}x_p \\ y_2 = a_{21}x_1 + a_{22}x_2 + ... + a_{2p}x_p \\ ... \\ y_p = a_{p1}x_1 + a_{p2}x_2 + ... + a_{pp}x_p \end{cases}$$

The principal components are calculated by decreasing order of importance, i.e., the first principal component is the combination that accounts for the largest amount of variance in the sample. The second principal component accounts for the next largest amount of variance and is uncorrelated with the first. Successive components explain progressively smaller portion of the total sample variance, and all are uncorrelated with each other.

The variance of the components is designated by eigenvalues. The size of the eigenvalues describes the dispersion of the data.

The mathematical model for factor analysis appears somewhat similar to a multiple regression equation, where each variable is expressed as a linear combination of factors that are not actually observed. In a general way, the model for the *ik th* variable can be written as:

$$[6.2] \quad X_i = a_{i1}F_1 + a_{i2}F_2 + ... + a_{ik}F_k + U_i$$

where,

$F's$ are the common factors;

U_i is the unique factor;

$a_{ik}'s$ are the coefficients used to combine the k factors.

The unique factors are assumed to be uncorrelated with each other and with the common factors.

The general expression for the estimate of the *i th* factor, F_i, is:

$$[6.3] \quad F_i = \sum_{j=1}^{p} W_{ij}X_j = W_{i1}X_1 + W_{i2}X_2 + ... + W_{ip}X_p$$

where,

W_i's are known as factor score coefficients, and ρ is the number of variables.

Before beginning the factor analysis, it should be explored each variable individually in terms of outliers, skewness, kurtosis and normality of the distribution. In case the asymmetry is very pronounced, it can be needed to transform one or more variables.

A) Steps in a factor analysis

Factor analysis usually proceeds in four steps:

1. In the first step, the correlation matrix for all variables is computed. Variables that do not appear to be related to other variables can be identified from the matrix and associated statitics. The appropriateness of the factor model can also be evaluated. One of the goals of factor analysis is to obtain factors that help explain these corelations, the variables must be related to each other for the factor model to be appropriate. If the correlations between variables are small, it is unlikely that they share common factors.

At this step, we should also decide what to do with cases that have missing values for some of the variables. In order to evaluate the appropriateness of this kind of model (factor analysis), we are going to analyze three methods: The Bartlett's test of sphericity, the Kaiser-Meyer-Olkin (KMO) measure and anti-image matrix. The Bartlett's test of sphericity can be used to test the hypothesis that the correlation matrix is an identity matrix, i.e., all diagonal terms are 1 and all off-diagonal terms are 0. The Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy is an index for comparing the magnitudes of the observed correlation coefficients to the magnitudes of the partial correlations coefficients. Small values for the KMO measure indicate that a factor analysis of the variable may not be a good idea, since correlations between pairs of variables cannot be explained by the others variables. Kaiser and Rice (1974) characterizes the KMO values as it is shown in table 6.2:

Table 6.2 – Characterization of the KMO values

KMO	Factor analysis classification
1 – 0,9	Marvelous
0,8 – 0,9	Meritorious
0,7 – 0,8	Middling
0,6 – 0,7	Mediocre
0,5 – 0,6	Miserable
< 0,5	Unacceptable

The anti-image matrix is another measure of sampling adequacy, the measures of sampling adequacy are displayed on the diagonals of the anti-image matrix. Again, reasonably large values are needed for a good factor analysis. Thus, we might consider eliminating variables with small values for the measure of sampling adequacy.

2. In the second step, factor extraction – the number of factors necessary to represent the data and the method for calculating them – must be determined. In order to determine the number of factors necessary we use the *Kaiser* method, with eigenvalues superior to one. At this step, we also ascertain how well the chosen model fits the data.

3. The third step, rotation, focuses on transforming the factors to make them more interpretable. We use the varimax method, which attempts to minimize the number of variables that have high loadings on a factor. This should enhance the interpretability of the factors, this method is the most commonly used.

4. At the forth step, scores for each factor can be computed for each case. These scores can then be used in a variety of other analyses, for example, regression analyses.

6.3. Sample and descriptive statistics

Our sample contains 2340 firms which are required to prepare consolidated financial statements, from 11 European countries (France, Portugal, Spain, Belgium, Holland, Italy, Greece, Lithuania, Romania, United Kingdom and Irland). It is the same sample used in the previous chapters, over a 20-year period, from 1990 to 2009. Financial and accounting information is retrieved from the *Thomson Datastream and WorldScope – Global Research Annual Industrial Files.* All companies were selected based on the information available in the database. We do not include in the sample bank institutions and insurance companies.

In the table 6.3, we proceed to the descriptive analysis of the earnings quality metrics – primary data. We use *PASW Statistics – version 18 (Statistical Package for Social Sciences)* to analyze data.

Table 6.3 – Descriptive analysis of the primary data: EQ measures

EQ measures	Mean	Median	Standard deviation	Skewness	Kurtosis
EQ_1	0,361	0,365	1,632	- 18,965	1014,741
EQ_2	0,329	0,372	0,371	- 0,753	0,787
EQ_3	0,243	0,043	3,142	32,025	1076,872
EQ_4	0,262	0,298	0,405	- 0,669	0,396
EQ_5	1,486	1,039	2,361	-10,417	148,176

Table 6.3 – Descriptive analysis of the primary data: EQ measures

EQ measures	Mean	Median	Standard deviation	Skewness	Kurtosis
EQ_6	-0,307	-0,388	0,501	0,656	-0,362
EQ_7	0,006	0,044	47,557	- 36,488	1640,844
EQ_8	0,589	0,135	23,059	- 12,439	610,052
EQ_9	0,115	0,008	2,811	25,182	1082,098
EQ_{10}	0,182	0,211	1,632	- 47,350	2242,000
EQ_{11}	0,171	0,165	0,252	2,166	4,010
EQ_{12}	0,201	0,089	0,266	1,782	2,404
EQ_{13}	0,175	0,157	0.268	2,060	3,262
EQ_{14}	0,251	0,206	0,371	- 0,753	0,787
EQ_{15}	1,566	1,005	0,142	- 0,025	0,897
EQ_{16}	0,765	0,635	1,632	- 18,965	1014,741
EQ_{17}	- 0,107	- 0,044	1,699	- 37,953	1552,835
EQ_{18}	0,001	0,000	2,411	-0,006	774,380
EQ_{19}	0,033	0,018	0,075	12,405	202,711
EQ_{20}	0,023	0,013	0,056	18,952	480,510

The analysis of the table 6.3 shows that generally the variables present close mean and median values, what leads us to conclude that the distributions are symmetrical or lightly asymmetric, and that the arithmetic mean can be used to describe the center of the distribution.

According to the asymmetry, we conclude that the distribution of the EQ_2, EQ_4, EQ_6, EQ_{14}, EQ_{15} and EQ_{18} variables are slightly asymmetric because skenness value is close to zero. The distributions of the all others variables are skewed. The variables EQ_3, EQ_9, EQ_{11}, EQ_{12}, EQ_{13}, EQ_{19} and EQ_{20} are very asymmetric, since the asymmetry coefficients take values greater than zero. These variables are concentrated to the left with a long tail to the right. Finally, the distributions of the variables EQ_1, EQ_5, EQ_7, EQ_8, EQ_{10}, EQ_{16} and EQ_{17} are concentrated to the right with a long tail to the left due to negative skenness value. Therefore, there is not a standard distribution for all variables analyzed.

Relatively to the *Kurtosis* measure we can conclude that almost all variables present distributions peaked and leptokurtic, except EQ_2, EQ_4, EQ_6, EQ_{14} and EQ_{15} variables. The distribution said to be leptokurstic because the coefficients of flatness or kurtosis have values greater than zero. When the absolute values of these coefficients are greater than 1, it can be assumed that the distribution of data is not the normal type, which is the case.

We can conclude that only the distributions of the EQ_2, EQ_4, EQ_6, EQ_{14} and EQ_{15} variables are normal.

However, as the assumption of the normality is not necessary to the construction of the principal components we won't proceed to any transformation of the data. Furthermore, as the number of observations is superior to 30 (n > 30), we may apply the central limit theorem, that is, we can admit that distributions are approximately normal.

6.4. Results of factor analysis (extraction of factors)

After the descriptive analysis of the primary data and the verification of the recommendations previously mentioned, the study began with the application of the factor analysis of principal components. Considering the exclusion of cases with missing values and the measure of sampling adequacy (MSA) computed for each individual variable[44], we suppress absolute values less than 0.3, the final results of our factor analysis are based in fifteen earnings quality (EQ) measures of the twenty EQ's initially considered. Our results excluded the EQ_3, EQ_{14}, EQ_{16}, EQ_{17} and EQ_{18} variables.

In a first stage, the correlations matrix was estimated. This matrix measures the linear association among the variables through the Pearson correlation coefficients (table 6.4). In order to apply the factor analysis of the principal components, the correlations among the variables should be statistically significant. The table 6.5 presents the statistical significance associated to the linear correlation among the variables.

[44] Reasonably large values of the measure of sampling adequacy (MSA) computed for each individual variable are needed for a good factor analysis. We might consider eliminating variables with small values for the measure of sampling adequacy. The measure of sampling adequacy is displayed on the diagonal of the anti-image correlation matrix.

Table 6.4 – Linear Correlations Matrix

Variables	EQ1	EQ2	EQ4	EQ5	EQ6	EQ7	EQ8	EQ9	EQ10	EQ11	EQ12	EQ13	EQ15	EQ19	EQ20
EQ1	1,00														
EQ2	-0,18	1,00													
EQ4	0,21	0,32	1,00												
EQ5	0,04	-0,02	0,18	1,00											
EQ6	-0,04	0,04	-0,17	0,35	1,00										
EQ7	0,05	0,01	0,04	0,03	-0,03	1,00									
EQ8	-0,01	0,04	0,05	-0,06	-0,18	-0,42	1,00								
EQ9	-0,01	-0,26	-0,06	0,03	-0,11	0,15	0,31	1,00							
EQ10	0,04	-0,26	-0,10	-0,15	-0,28	0,03	0,21	0,55	1,00						
EQ11	-0,18	-0,01	-0,03	0,07	0,03	-0,02	-0,03	-0,10	0,02	1,00					
EQ12	0,04	-0,26	-0,10	-0,15	-0,28	0,03	0,21	0,55	0,05	0,15	1,00				
EQ13	-0,18	-0,01	-0,03	0,07	0,03	-0,02	-0,03	-0,10	0,02	0,03	0,02	1,00			
EQ15	-0,31	0,21	0,31	0,19	-0,11	-0,00	-0,05	-0,22	0,001	0,71	0,10	0,18	1,00		
EQ19	-0,11	-0,07	-0,10	0,05	0,06	-0,02	-0,04	-0,04	0,03	0,92	0,46	1,00	0,46	1,00	
EQ20	-0,12	-0,13	-0,04	-0,08	0,18	0,03	-0,16	-0,06	0,07	0,76	0,45	0,79	0,45	0,79	1,00

Table 6.5 – Linear Correlations Significance Matrix

Variables	EQ1	EQ2	EQ4	EQ5	EQ6	EQ7	EQ8	EQ9	EQ10	EQ11	EQ12	EQ13	EQ15	EQ19	EQ20
EQ1															
EQ2	0,104														
EQ4	0,065	0,010													
EQ5	0,398	0,450	0,101												
EQ6	0,394	0,391	0,109	0,006											
EQ7	0,374	0,459	0,394	0,426	0,403										
EQ8	0,484	0,384	0,361	0,333	0,096	0,001									
EQ9	0,482	0,031	0,349	0,413	0,210	0,141	0,011								
EQ10	0,389	0,029	0,245	0,137	0,020	0,421	0,071	0,000							
EQ11	0,099	0,468	0,416	0,314	0,421	0,450	0,431	0,240	0,440						
EQ12	0,013	0,063	0,012	0,089	0,209	0,496	0,369	0,058	0,498	0,000					
EQ13	0,214	0,321	0,235	0,370	0,326	0,452	0,389	0,389	0,424	0,042	0,000				
EQ15	0,013	0,063	0,012	0,089	0,209	0,496	0,369	0,058	0,498	0,332	0,391	0.000			
EQ19	0,214	0,321	0,235	0,370	0,326	0,452	0,389	0,389	0,424	0,012	0,036	0,324	0,000		
EQ20	0,195	0,172	0,382	0,286	0,094	0,406	0,134	0,339	0,304	0,001	0,000	0,000	0,000	0,000	

For a 5% significance level, we can see that most of the correlations among the variables are not significant, which indicates that the factor analysis is not very adapted for these data.

However, the appropriateness of the factor model should also be evaluated observing the results of Bartlett's test of sphericity, the Kaiser-Meyer-Olkin (KMO) measure and anti-image matrix.

The following table 6.6 presents the results of the Bartlett's test and KMO statistics to analyze the validity of the application of the factor analysis for this sample. The value of KMO statistics is close to 0.6, which permits to conclude that the application of the factor analysis is acceptable but mediocre.

Table 6.6 – KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy		0,588
Bartlett's Test of Sphericity	Approx. Chi-Square	7697,528
	Df	105
	Sig.	0,000

From the table 6.6, the value of the test statisc for the Bartlett's test of sphericity is large and the associated significance level is small, so it appears unlikely that the population correlation matrix is an identity. If the hypothesis that the population correlation matrix is an identity can not be rejected because the observed significance level is large, we should reconsider the use of the factor model. However, we would like to enhance that the Bartlett's test of sphericity requests the data to come from a normal sample, which is not the case for most of the variables in the analysis.

In table 6.7 we present the values of the anti-image matrix, namely, the measures of sampling adequacy (MSA) displayed on the main diagonal, which vary between 0.414 and 0.730. As all values are superior to 0.5, except one (0.414), they indicate that we can apply the factor analysis. Larger values of the measures of sampling adequacy are needed for a good factor analysis.

Table 6.7 – Anti-image matrix

Variables	**EQ1**	**EQ2**	**EQ4**	**EQ5**	**EQ6**	**EQ7**	**EQ8**	**EQ9**	**EQ10**	**EQ11**	**EQ12**	**EQ13**	**EQ15**	**EQ19**	**EQ20**
EQ1	0,615[a]														
EQ2	0,184	0,582[a]													
EQ4	-0,46	-0,23	0,730[a]												
EQ5	-0,13	0,270	-0,10	0,573[a]											
EQ6	0,054	-0,27	0,177	-0,54	0,520[a]										
EQ7	-0,13	-0,18	0,135	-0,04	0,144	0,414[a]									
EQ8	-0,04	-0,17	-0,00	0,019	0,124	0,509	0,543[a]								
EQ9	0,270	0,163	-0,23	-0,18	-0,01	-0,35	-0,36	0,571[a]							
EQ10	-0,19	0,085	0,218	0,127	0,171	0,096	-0,01	-0,54	0,582[a]						
EQ11	-0,24	0,164	0,305	0,285	-0,26	-0,02	-0,12	-0,13	0,141	0,634[a]					
EQ12	0,418	-0,20	-0,43	-0,42	0,327	-0,03	0,064	0,285	-0,23	-0,85	0,652[a]				
EQ13	0,163	-0,22	-0,14	-0,36	0,314	0,054	0,075	0,075	-0,06	-0,90	0,730	0,700[a]			
EQ15	0,418	-0,20	-0,43	-0,42	0,327	-0,03	0,064	0,285	-0,23	-0,85	0,369	-0,004	0,695[a]		
EQ19	0,163	-0,22	-0,14	-0,36	0,314	0,054	0,075	0,075	-0,06	-0,90	0,730	0,477	0,001	0,518[a]	
EQ20	0,011	0,299	-0,16	0,441	-0,46	-0,07	0,106	-0,00	-0,11	0,137	-0,25	-0,45	-0,041	-0,867	0,520[a]

[a] Measures of sampling adequacy (MSA).

Considering the results of the correlations matrix, the Bartlett's test of sphericity, the Kaiser-Meyer-Olkin measure, the anti-image matrix, namely, the measures of sampling adequacy computed for each individual variable, we can conclude that the factor analysis is appropriate to the data, although it is not meritorious or middling, it is mediocre.

The results of the factor extraction are displayed in table 6.8. The goal of factor extraction is to determine the number of factors necessary to represent the data. The next table 6.8 contains the coefficients used to express a standardized variable in terms of the factors. These coefficients are called factor loadings, since they indicate how much weight is assigned to each factor. Factor with large coefficients (in absolute value) for a variable are closely related to the variable. The matrix of factor loadings is called the factor pattern matrix. To identify the factors, it is necessary to group the variables that have large loadings for the same factors. Another convenient strategy is to sort the factor pattern matrix so that variables with high loadings on the same factor appear together, as shown in table 6.8. Small factor loadings were omitted from such table. In table 6.8, no loadings less than 0.3 in absolute value are displayed.

Table 6.8 – Factor extraction, after varimax rotation

	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6
Time-series properties (persistence and predictability)						
EQ2	0,783					
EQ1	0,723					
EQ4	0,589					
Relevance						
EQ10		0,820				
EQ12		0,758				
EQ11		0,667				
EQ13		0,443				
Accruals quality						
EQ19			0,837			
EQ20			0,829			
Informativeness of earnings						
EQ8				0,650		
EQ9				0,420		
EQ7				0,515		

Table 6.8 – Factor extraction, after varimax rotation

	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6
Smotheness						
EQ6					0,446	
EQ5					0,412	
Timeliness						
EQ15						0,366
Total variance	2,626	2,486	1,856	1,395	1,315	1,040
% of variance explained	17,51%	16,57%	12,37%	9,30%	8,77%	6,93%
% of cumulative variance explained	17,51%	34,08%	46,46%	55,76%	64,52%	71,46%
Cronbach's Alpha based on standardized items	0,660	0,598	0,862	0,260	0,369	-

The factor analysis of the principal components, based on the Kaiser approach, resulted in the extraction of six factors responsible for 71.46% of the total variance explained. The value of the explained variance allows us to conclude that the factor analysis of the principal components is acceptable because it is superior to 50%.

To help us decide how many factors we need to represent the data, it is helpful to examine the percentage of total variance explained by each. The total variance is the sum of the variance of each variable. The linear combination formed by factor 1 has a percentage of variance explained of 17.51%, the factor 2 is responsible for 16.57% of the total variance, factor 3, factor 4, factor 5 and factor 6 have a percentage of variance explained of 12.37%, 9.30%, 8.77% and 6.93%, respectively. Note that the factors are arranged in descending order of variance explained.

The six factors are the following:

Factor 1 - Time-series properties (persistence and predictability) are measured by EQ_2, EQ_1 and EQ_4.

Factor 2 - Relevance is by EQ_{10}, EQ_{12}, EQ_{11} and EQ_{13}.

Factor 3 – Accruals quality is measured by EQ_{19} and EQ_{20}.

Factor 4 – Informativeness of earnings is measure by EQ_8, EQ_9 and EQ_7.

Factor 5 – Smoothness is measure by EQ_6 and EQ_5.

Factor 6 – Timeliness is only constituted or measured by one earnings quality measure, namely EQ_{15}.

In the previous chapter 3, we defined these dimensions or factors.

In table 6.8, the Cronbach's alpha is also displayed for each factor. The Cronbach's alpha is one of the most commonly used reliability coefficients. Alpha (or α) is based on the "internal consistency" of a test. That is, it is based on the average correlation of items within a test. Standardized item alpha, is the α value that would be obtained if all of the items were standardized to have a variance of 1.

Cronbach's alpha (or α) assess the internal consistency reliability of the each dimension or factor extracted and each item. One measure of a latent variable is reliable if it is consistent. One of the basic problems in a study based on multidimensional variables or dimensions, consists in the internal consistency reliability of the items used to define each dimension or factor extracted. The assessment of the internal consistency was made taking into account the scale proposed by Hill and Hill (2000: 149), which is presented in table 6.9.

Table 6.9 – Internal consistency classification based on Cronbach's alpha (or α)

Cronbach's alpha (or α)	**Internal consistency classification**
α > **0,9**	Excelent
0,9 > α > **0,8**	Good
0,8 > α > **0,7**	Middling
0,7 > α > **0,6**	Mediocre
α < **0,6**	Unacceptable

According to table 6.8, the factor 3 (accruals quality) has a Cronbach's alpha of 0.862, which means that there is a good internal consistency among items (EQ_{19} and EQ_{20}), that is, the items considered measure what it is intended to measure.

Factor 1 (time-series properties – persistence and predictability) and factor 2 (relevance) have a Cronbach's alpha which range from 0.7 and 0.6, which means that there are a mediocre internal consistency among items.

In general, the results of this empirical study shows that through the application of a factor analysis of principal components is possible to delimitate the basic constructs and measures of the earnings quality (EQ) concept, reviewed in chapter 3. The results of our factor analysis of principal components corroborate our theoretical assumptions that through this data reduction technique we can obtain a set of main factors, which means, factor scores or underlying dimensions of earnings quality.

The scores for each factor can be computed for each case. In future research, these scores can be used in a variety of other analyses, for example, regression analyses.

Therefore, two main ideas have to be considered, in terms of limitations of these results:

- First, three dimensions (accruals quality, smoothness and timeliness) rest on just two items and one item, respectively, which is an undesirable situation for the confirming factor analyses (Byrne, 1998).
- Second, the last dimension (timeliness) is just constituted by only one item, which does not even facilitate the calculation of the internal consistency of the factor.

To solve these two concerns, it is necessary:

- To improve the constructs quality, it is necessary to increase new items to the dimensions under analysis;
- To increase the number of observations in the sample.

A test must be reliable to be useful. But it's not enough for a test to be reliable; it must also be valid. That is, the instrument must measure what it is intended to measure. There are many different ways to assess both reliability and validity. In this chapter we are concerned with to discover a simple pattern in the pattern of relationships among the variables and with measures of reliability. In future, it is important to validate this measure instrument in a regression analyses, for example.

6.5. Summary and concluding remarks

The literature on earnings quality currently embraces various aspects of this nebulous concept. A sole definition of earnings quality can not be found.

Considering the multidimensional nature of the earnings quality concept and the multiplicity of measures existing in the literature, our objective in this chapter was to develop a measure instrument which allows to delimitate the basic constructs and measures of the earnings quality concept, through the application of exploratory multivariate analysis, namely, factor analysis of principal components.

The goal of factor analysis is to identify the not-directly-observable factors based on a set of observable variables. The mathematical model for factor analysis appears somewhat similar to a multiple regression equation.

The results of our factor analysis suggest six different dimensions of earnings quality: (1) time-series properties (persistence and predictability); (2) relevance; (3) accruals quality; (4) informativeness of earnings; (5) smoothness; and (6) timeliness.

However, the empirical evidence gathered shows that constructs quality should be improved, and that it is necessary to increase new EQ metrics to the dimensions under analysis (or other ones), and that the dimension of the sample should also be increased. Future research should thus focus on trying to develop a more complete measure of earnings quality and to validate it.

"(…) It is better to face the fight right away, and reach victory even exposing oneself to failure, than lining up with those poor in spirit, who do not suffer much nor enjoy much because they live in that grey twilight that knows not victory nor defeat (…)"

T.Roosevelt

CONCLUSION

Being usually recognized the importance of the earnings in evaluating the performance of a company, the problem lies on the selection of the elements that allow the concrete measure of earnings quality. It is therefore important to define the various meanings, identifying ways of measuring the attributes that provide quality to the accounting earnings.

The main objectives of this thesis are to provide a better and deeper understanding of the vectors of analysis in what concerns the dimensions of earnings quality concept, constructs and measures, considering its multidimensional nature and to propose a "new" earnings quality perspective taking into account the virtuosities of the residual income model.

We focus on the use of earnings as measure of company performance. Specifically, we take the position that a high-quality earnings number will do three things: it will reflect current operating performance; it will be a good indicator of future operating performance; and it will accurately annuitize the intrinsic value of the company.

This final chapter reflects on the outcomes of the thesis in respect of the three strands of analysis outlined in introduction. Outcomes are assessed principally in terms of their enhancement of theoretical understanding and their practical contributions. The chapter also present some limitations of the thesis and outlines some suggestions for further research.

1 - Overview of key findings

In chapter 1 the different earnings quality definitions were explored and the relevant literature on studies about the relationship between financial statement data and firm value was presented.

We concluded that the subject of earnings quality is a complex area and no researcher has been able to provide a unique definition of earnings quality, neither to find an adequate measure for it. The concept is complex and nebulous.

Some of the most important definitions, constructs and measures of earnings quality are related with the persistence, predictability and variability of earnings (time-series properties of earnings). Others authors relate earnings quality to the relation between income, accruals and cash, taking the view that earnings that map more closely into cash are more desirable (*e.g.*, Penman, 2001; Harris *et al.*, 2000). Schipper and Vicent (2003) view earnings quality in relations to Hicksian income and Dechow *et al.* (2010: 344) consider that earnings quality is "conditional on the decision-relevance of the information", so, they consider that earnings quality is defined only in the context of a specific decision model.

However, in general, all agree that earnings quality is a summary measure in performance evaluation and a focal question to assess the quality of accounting information. A high-quality earnings number will reflect current operating performance, being a good indicator of future operating performance, and is a useful summary measure for assessing firm value.

In spite of the complexity of determining earnings quality and its implications for firm value, the valuation models based on earnings and book value, the main sources of firm value, are viewed typically as an alternative approach to assess the firm value. The use of earnings quality concept in various valuation models can be theoretically justified, once that higher earnings quality, the more useful the earnings data as a forecasting metric and the more accurate the valuation.

With the above in mind and knowing that earnings are important for evaluation effects and the investors see in earnings a valuable information source to assess the firm value, we proposed, in chapter 2, a "new" earnings quality perspective, which means a "new" link between the three earnings quality constructs, persistence, predictability and informativeness, based on the virtuosities of the residual income model adopted by Ohlson (1995) and its subsequent refinements by Feltham and Ohlson (1995) and Ohlson (1999). In fact, the quality of accounting information is a function of its relevance – a function of its predictability, informativeness and confirmatory value.

Information has predictive value if it has value (high quality) as an input to the predictive processes, that is if it is used by investors to form their own expectations about the future. In this sense, earnings quality concept is a way to assess the relevance, the reliability of earnings, in short, the informativeness of earnings, in terms of value relevance.

In our proposed model, presented in chapter 2 and operationalized empirically in chapters 3 and 4, we redesign the linear information model (LIM) structure of accounting information in relation to the market value added and taking to account the earnings quality concept. We reinterpret rebuilding the base models (Ohlson, 1995; Feltham and Ohlson, 1995; Ohlson, 1999), analyzing them and introducing some modifications, namely:

- The dependent variable of our valuation equations is the market value added, that means, the difference between the current market and book values of common equity. We express the valuation function in terms of goodwill;

- We consider the valuation formula in line with earnings response coefficient (ERC) literature, we also (re)interpret the β *coefficients* of the valuation equations as a *score* and as that as a *proxy* of the informativeness of market value added. With LIM structure β *coefficients* provide a composite measure of earnings quality (EQ) that simultaneously captures the persistence (ω_{11}, γ_{22}), the predictability (ω_{12}) and the informativeness of earnings (β) and its components, building a composite and three-dimensional measure of earnings quality (EQ);

- And, in our linear information dynamic formulation the role of the *other information* (v_{it}) is underlined. In sipte of the vagueness and fuzzy nature of this variable, its potentialities are pointed out by many authors that recognize its importance in the industry-specific or entity-specific treatment of the model;

In chapter 4, we tested empirically our linear information model (LIM) and the results obtained were the following:

- We didn't corroborate our first hypothesis. The first hypothesis intended to test whether imposing linear information structure is important to draw inferences from valuation equations based on residual income models. Our results revealed that predictions erros differ significantly when the linear information model (LIM) structure is imposed, consequently, these findings support the efficacy of drawing inferences from valuation equations based on residual income models that do not impose the structure implied by the model;

- Our second hypothesis was not corroborated, too. Our findings show that informativeness of earnings seems to capture *per si* all the relevant value information of earnings. In our sample, β *coefficients* capture better the informativeness of earnings alone than if we impose the linear information model (LIM) structure, that is, if we impose the behavior theoretically supported by Ohlson (1995);

- We corroborated our third hypothesis, once that the valuation coefficient of net income differs from that of total accruals, and those of the four major accruals components differ from each other. So, our findings suggest that disaggregating earnings into cash flow and total accruals, and total accruals into its major components aid in predicting market value added;

- Finally, our forth hypothesis was also corroborated, because taking to account the convexity of earnings (Hayn, 1995), we tested our relations in a positive earnings sample. Our findings suggest that loss cases have a dampening effect on the measures of the information content of earnings. When we consider only positive earnings the magnitudes of the valuation parameter estimates and the values of adjusted R^2 are better performed. Therefore, convexity of earnings must be taken into account to assess the informativeness and persistence of earnings.

In chapter 5, considering that it is expected that accruals and cash flows components of earnings have different ability to predict future abnormal earnings, different persistence, different predictability and different valuation implications, we performed a separate industry estimations, according to the system of equations for each earnings components (accruals and cash flows), and we built two portfolios of firms with the estimated coefficients - portfolios of firms with high earnings quality and portfolios of firms with low earnings quality - and we corroborated our hypotheses (H_{1a}-H_{1b}, H_{2a}-H_{2b}). We concluded that:

- Informativeness of earnings are significantly higher in portfolios of firms with high quality earnings (high persistence of abnormal earnings and low (high) predictability of accruals (cash flows)) compared to portfolios of firms with low quality earnings (low persistence of abnormal earnings and high (low) predictability of accruals (cash flows));

- Explanatory powers of earnings to explain market value added are significantly higher in portfolios of firms with high quality earnings (high persistence of abnormal earnings and low (high) predictability of accruals (cash flows)) compared to portfolios of firms with low quality earnings (low persistence of abnormal earnings and high (low) predictability of accruals (cash flows)).

Basing our tests on Ohlson (1999), which extends the Ohlson and Feltham-Ohlson framework (Ohlson, 1995; Feltham and Ohlson, 1995) by modelling earnings components, just as Barth *et al.* (1999), we also concluded that:

– Accruals and cash flows aid in forecasting future abnormal earnings;
– The two components, accruals and cash flows, do not have the same ability to predict future abnormal earnings, in particular, the coefficients on accruals and cash flows are negative and positive, respectively, indicating that abnormal earnings is less persistent when accruals comprise a larger proportion of current earnings, as previously predicted;
– Considering the definition of net income, that it is equals accruals plus cash flows, we observe that the findings relating to accruals and cash flows in abnormal earnings equations are “mirror images” of each other;
– Comparisons of the autoregressive parameter estimates across industries shows that accruals are less persistent than cash flows for almost all industries;

- The interaction between two key characteristics of the components, their ability to aid in forecasting future abnormal earnings (predictability) and the persistence of the components themselves, results in different valuation implications of the accruals and cash flows components of earnings;
- Accruals and cash flows provide explanatory power for maket value added, both components have value relevance in that their estimated total valuation coefficients differ from zero, indicating that they have a significant relation with market value added.

In chapter 3, we identified in the literature the different constructs and measures, concerning to the multidimensional nature of the earnings quality concept, that have been most used in academic accounting research and in teaching and we classify them in three main categories; earnings quality constructs that derive from (1) the time-series properties of earnings; (2) the accruals quality; (3) selected qualitative characteristics in the conceptual framework of IASB/FASB. In appendix 3, we summarized all measures and constructs reviewed in this chapter 3.

Consequently, in chapter 6, considering all constructs and measures reviewed in chapter 3, we test empirically whether factor analysis provides a deeper understanding of the relevant dimensions of earnings quality concept and permits to delimitate the basic constructs and measures of the earnings quality (EQ) concept reviewed.

The main purpose of the chapter 6 was to develop a measure instrument which allows to delimitate the basic factors of the earnings quality concept, through the application of exploratory multivariate analysis, namely, factor analysis of principal components. The goal of factor analysis is to identify the not-directly-observable factors based on a set of observable variables.

The results of our factor analysis of principal components corroborate our theoretical assumptions that through this data reduction technique we can obtain a set of main factors, which means, factor scores or underlying dimensions of earnings quality.

The results of our factor analysis suggest six different dimensions of earnings quality: (1) time-series properties (persistence and predictability); (2) relevance; (3) accruals quality; (4) informativeness of earnings; (5) smoothness; and (6) timeliness.

2 - Contributions

This thesis contributes to the literature in a number of ways and it has enhanced theoretical and empirical understanding of the earnings quality subject.

First, this thesis provides a structure for understanding earnings quality. It provides an understanding of the vectors of analysis in what concerns the dimensions of earnings quality concept, constructs and measures, according to the multidimensional nature of the concept.

Second, at a theoretical level, this thesis adds a new link between the three perspectives of earnings quality: persistence, predictability and informativeness, based on the residual income model. Highlightening the virtuosities of the residual income model, we proposed a "new" earnings quality perspective, focusing our analysis in the link between contemporaneous and future earnings, in line with the linear information dynamics (Ohlson, 1995; Feltham and Ohlson, 1995; Ohlson, 1999; Barth *et al.*, 1999 and 2005). We reinterpret rebuilding this link considering the tridimensional dimension of the earnings quality concept: persistence, predictability and informativeness.

The link between accounting and contemporaneous equity values have been extensively studied. Nevertheless, no study, to our knowledge, has tested whether and to what extent disaggregating earnings, imposing linear information structure of accounting numbers, aid in predicting contemporaneous market value added and provide a composite measure of earnings quality (EQ) that simultaneously captures the persistence, the predictability and the informativeness of earnings.

And, third, at the empirical level and taking into account the multidimensional nature of the earnings quality concept, we operationalized a large multiplicity of measures and constructs through the application of factor analysis in order to obtain a *score*, which means, a measure instrument that delimitates the basic constructs and measures of earnings quality concept. To our knowledge, this is the first study that operationalizes simultaneously a large diversity of constructs and measures used to assess the earnings quality concept.

The determination of the sources of firm value is a central concern of accounting and finance research that is far from exhausted. With the theoretical and empirical approach of this thesis we hope to have contributed to the clarification of this issue by introducing a theoretical framework of analysis little used by Portuguese scientific community, in order to raise new questions and to encourage their further study.

3 - Limitations

Recognizing that a research study is always a work in progress, with limitations and some aspects to improve in future research, we present some of the limitations of this work and we hope to solve them in future research.

Some of the limitations of this work are:

– In the empirical part, namely, chapter 4 and chapter 5, some coefficients of some variables should have been better analyzed, in particular, the coefficients of the *other information* variable. It should have been made a more detailed descriptive analysis for the *other information* variable and analyze its economic implications.

– Knowing that the magnitude of earnings and its components, accruals and cash flows, depends on a number of company characteristics, such as the company's stage in its life cycle, the length of its operating cycle, and the volatility of its underlying operations, in chapter 5 about separate industry estimations, we should have paid more attention to the firm characteristics.

– In spite of the results of the empirical study of the chapter 6 show that through the application of the factor analysis of principal components is possible to delimitate the basic constructs and measures of the earnings quality (EQ) concept reviewed, the empirical evidence gathered also shows that constructs quality should be improved, and that it is necessary to increase new EQ metrics to the dimensions under analysis (or other ones), and that the dimension of the sample should also be increased. Future research should thus focus on trying to develop a more complete measure of earnings quality and to validate it.

4 – Opportunities for future research

With the above in mind, namely that magnitude of earnings and its components, accruals and cash flows, depends on a number of company characteristics, and that a more complete measure of earnings quality should be develop and validate, in future research, we can develop a model that examines the relation between our earnings quality measure, obtained from factor analysis, and firm characteristics.

In fact, as we explained previously, the scores for each factor can be computed and used in a variety of other analyses, for example, regression analyses. And any expression on earnings quality is a function of the period of the analysis, the industry composition of the sample, the life cycle stage in which the firm is, the components of earnings, etc.

As we explained in the previous chapters, our sample consists of all domestic listed firms from 11 European countries that are required to prepare consolidated financial statements and we obtained data for the 1990-2009 period from the *Thomson Datastream and WorldScope – Global Research Annual Industrial Files*.

Knowing that:

– after 2005 all listed firms in the European Union (EU) had report its financial statements according to the International Financial Reporting Standards/International Accounting Standards (IFRS/IAS); and

– the eleven Europen countries considered in our sample are: Belgium, France, Greece, Holland, Ireland, Italy, Lithuania, Portugal, Romania, Spain and United Kingdom. Our sample is made in agreement with firms based on code law countries and common law countries. Based on previous studies (*e.g.*, Hail and Leuz, 2007; Barth *et* *al.*, 2008; Cabrita and Isidro, 2008; Landsman *et al.*, 2009; Chen *et al.*, 2009), the group of code law countries are constituted by Belgium, France, Greece, Holland, Italy, Lithuania, Portugal, Romania and Spain. Countries that are part of the common law are the United Kingdom and Ireland,

we intend to test empirically, in future research, if there is a different impact on information content of annual earnings in code law countries as opposed to the common law countries and in the following sub-periods:

a) the period before of firms have started to use IFRS/IAS (before 2005);

b) the period after of firms have started to use IFRS/IAS (after 2005).

REFERENCES

1 – Direct references

AICPA, American Institute of Certified Public Accountants (1994). *Improving Business Reporting – A Customer Focus, Comprehensive Report of the Special Committee on Financial Reporting*. New York, AICPA.

AIMR, Association for Investment Management and Research (1993). *Financial Reporting in the 1990s and Beyon*d. Charlottesville, AIMR.

Ahmed, A.; Morton, R. M. and Schaefer, T. F. (2000). Accounting Conservatism and the Valuation of Accounting Numbers: Evidence on the Feltham-Ohlson Model (1996). *Journal of Accounting, Auditing and Finance*, 15 (3), pp. 271-292.

Ahmed, A.; Billings, B. and Morton, R. (2004). Extreme Accruals, Earnings Quality, and Investor Mispricing. *Working Paper, Florida State University*.

Ali, A. and Zarowin, P. (1992). The Role of Earnings Levels in Annual Earnings-Returns Studies. *Journal of Accounting Research*, 30 (2), pp. 286-296.

Amir, E. and Lev, B. (1996). Value-Relevance of Non-Financial Information: The Wireless Communications Industry. *Journal of Accounting and Economics*, 22, pp. 3-30.

Ball, R.; Kothari, S. and Robin, A. (2000). The Effect of International Institutional Factors on Properties of Accounting Earnings. *Journal of Accounting and Economics*, 29 (1), 1-51.

Baltagi, B. (2005). *Econometric Analysis of Panel Data*. 3rd edition, John Wiley & Sons, Ltd.

Balsam, S.; Krishnan, J. and Yang, J. (2003). Auditor Industry Specialisation and Earnings Quality. *Auditing: A Journal of Practice and Theory*, September, 22, pp. 71-97.

Barrow, M. (2003). *Statistics for Economics, Accounting and Business Studies*. 2nd edition, Longman.

Barth, M.; Beaver, W. and Wolfson, M. (1990). Components of Bank Earnings and the Structure of Bank Share Prices. *Financial Analysts Journal*, May/June, pp. 53-60.

Barth, M. (1991). Relative Measurement Errors Among Alternative Revision Asset and Liability Measures. *The Accounting Review*, July, pp. 433-463.

Barth, M.; Beaver, W. and Landsman, W. (1992). The Market Valuations Implications of Net Periodic Pension Costs. *Journal of Accounting and Economics*, 15, pp. 27-62.

Barth, M.; Beaver, W. and Landsman, W. (1998). Relative Valuation Roles of Equity Book Value and Net Income as a Function of Financial Health. *Journal of Accounting and Economics*, 25, pp. 1–34.

Barth, M.; Beaver, W.; Hand, J. and Landsman, W. (1999). Accruals, Cash Flows and Equity Values. *Review of Accounting Studies,* 3, pp. 205-229.

Barth, M. and Hutton, A. (1999). Information Intermediaries and the Pricing of Accruals. *Working paper, Stanford University.*

Barth, M.; Cram, D. and Nelson, K. (2001a). Accruals and Prediction of Future Cash Flows. *The Accounting Review*, 76, pp. 27-58.

Barth, M.; Beaver, W. and Landsman, W. (2001b). The Relevance of the Value Relevance Literature for Financial Accounting Standard Setting: Another View. *Journal of Accounting and Economics*, 31, pp. 77-104.

Barth, M.; Beaver, W.; Hand J. and Landsman, W. (2005). Accruals, Accounting-Based Valuation Models, and the Prediction of Equity Values. *Journal of Accounting, Auditing and Finance*, 3, pp. 311–345.

Barth, M.; Landsman, W. and Lang, M. (2008). International Accounting Standards and Accounting Quality. *Journal of Accounting Research*, 46, pp. 467-498.

Barua (2006). Using the FASB's Qualitative Characteristics in Earnings Quality Measures. *P.h.D Dissertation, Graduate Faculty of the Louisiana State University and Agricultural and Mechanical College.*

Basu, S. (1997). The Conservatism Principle and the Asymmetric timeliness of Earnings. *Jounal of Accounting and Economics*, 24, pp. 3-37.

Beaver, W. (1998). *Financial Reporting: An Accounting Revolution*. 3rd edition, Prentice Hall.

Beaver, W. (1999). Comments on "An Empirical Assessment of the Residual Income Valuation Model". *Journal of Accounting and Economics,* 26, pp. 35-42.

Beaver, W. (2002). Perspectives on Recent Capital Research. *Accounting Review*, 77 (2), pp. 453-474.

Bernard, V. (1995). The Feltham–Ohlson Framework: Implications for Empiricists. *Contemporary Accounting Research*, 11, pp. 733–747.

Berger, P.; Ofek, E. and Swary, I. (1996). Investor Valuation of the Abandonment Option. *Journal of Financial Economics*, 42, pp. 257-287.

Bernard, V. and Stober, T. (1989). The Nature and Amount of Information in Cash Flows and Accruals. *The Accounting Review,* 64 (4), pp. 624-652.

Bernstein, L. and Siegel, J. (1979). The Concept of Earnings Quality. *Financial Analysts Journal*, July-August, pp. 72-75.

Bernstein, L. (1996). *Análisis de Estados Financeiros. Teoría, Aplicación e Interpretación*. Madrid: Ed. IRWIN.

Bibliorum Sacrorum Nova Vulgata Edition, Lc 12, 48b.

Black, F. (1980). The Magic in Earnings: Economic Earnings verus Accounting Earnings. *Financial Analysts Journal*, 36, pp. 19-24.

Brown, L. (1996). Influencial Accounting Articles, Individuals, Ph.D. Granting Institutions and Faculties: A Citation Analysis. *Accounting Organizations and Society*, 21, pp. 723-754.

Burgstahler, D. and Dichev, I. (1997). Earnings, Adaptation and Equity Value. *Accounting Review*, 72, pp. 187-215.

Bushee, B. (1998). The Influence of Institutional Investors on Myopic R&D Investment Behavior. *The Accounting Review*, 73 (2), pp. 305-333.

Bushman, R.; Chen, Q.; Engel E. and Smith A. (2004). Financial Accounting Information, Organizational Complexity and Corporate Governance Systems. *Journal of Accounting and Economics*, 37 (2), pp. 139-201.

Butler, M.; Leone, A. and Willenborg, M. (2004). An Empirical Analysis of Auditor Reporting and its Association with Abnormal Accruals. *Journal of Accounting and Economics*, 37 (2), pp.139-165.

Cabrita, P. and Isidro, H. (2008). *A Relevância da Informação Financeira Antes e Após a Adopção das IAS/IFRS*. Tese de Mestrado, ISCTE.

Canadas, N. (2004). *Um Modelo Dual de Análise, Avaliação e Relato do Valor Intangível: O Caso das Telecomunicações Móveis em Portugal*. Tese de Doutoramento, Universidade do Minho.

Chamberlain, S. and Anctil, R. (2003). Determinants of the Time-Series of Earnings and Implications for Earnings Quality. *Working paper, University of British Columbia*.

Chan, K.; Chan, L.; Jegadeesh, N. and Lakonishok, J. (2006). Earnings Quality and Stock Returns. *Journal of Business*, 79 (3), pp. 1041-1082.

Chaney, P.; Jeter, D. and Lewis, C. (1998). The Use of Accruals in Income Smoothing: A Permanent Earnings Hypothesis. *Advances in Quantitative Analysis of Finance and Accounting*, 6, pp. 103–135.

Chen, C.; Lin, C. and Lin, Y. (2004). Audit Partner Tenure, Audit Firm Tenure, and Discretionary Accruals: Does Longer Auditor Tenure Impair Earnings Quality? *Working Paper, Hong Kong University of Science and Technology*.

Chen, H.; Tang, Q.; Jiang, Y. and Lin, Z. (2009). International Financial Reporting Standards and Accounting Quality: Evidence from European Union. *SSRN Working Paper Series, June version*.

Cohen, D. (2004). Quality of Financial Reporting Choice: Determinants and Economic Consequences. *Working Paper, Northwestern University*.

Collins, D.; Kothari, S. and Rayburn J. (1987). Firm Size and the Information Content of Prices with Respect to Earnings. *Journal of Accounting and Economics*, 9, pp. 111-138.

Collins, D. and Kothari, S. (1989). An Analysis of Intertemporal and Cross-Sectional Determinants of Earnings Response Coefficient. *Journal of Accounting and Economics*, 11, pp. 143-181.

Collins, D.; Kothari, S.; Shanken J. and Sloan, R. (1994). Lack of Timeliness and Noise as Explanations for the Low Contemporaneous Returns-Earnings Association. *Journal of Accounting and Economics*, 18, pp. 289-324.

Collins, D.; Maydew, E. and Weiss, I. (1997). Changes in the Value-Relevance of Earnings and Book Values Over the Past Forty Years. *Journal of Accounting and Economics,* 24 (1), pp. 39-67.

Collins, D.; Pincus, M. and Xie, H. (1999). Equity Valuation and Negative Earnings: The Role of Negative Earnings. *The Accounting Review*, 74, pp. 29-61.

Davidson, R. and MacKinnon, J. (2004). *Econometric Theory and Methods*. Oxford University Press.

Davidson, R. and Mackinnon, J. (1993). *Estimation and Inference in Econometrics*. Oxford University Press.

DeAngelo, L. (1986). Accounting Numbers as Market Valuation Substitutes: A Study of Management Buyouts of Public Stockholders. *The Accounting Review*, 61, pp. 400-420.

Dechow, P. and Sloan, R. (1991). Executive Incentives and the Horizon Problem: An Empirical Investigation. *Journal of Accounting and Economics*, 14, pp. 51–89.

Dechow, P. (1994). Accounting Earnings and Cash Flows as Measure of Firm Performance: The Role of Accounting Accruals. *Journal of Accounting and Economics*, 18, pp. 3-42.

Dechow, P.; Sloan, R. and Sweeney, A. (1995). Detecting Earnings Management. *The Accounting Review*, 70, pp. 193-225.

Dechow, P.; Sloan, R. and Sweeney, A. (1996). Causes and Consequences of Earnings Manipulation: An Analysis of Firm Subject to Enforcement Actions by the SEC. *The Contemporary Accounting Research*, 13 (1), pp. 1-36.

Dechow, P., Kothari, S. and Watts, R. (1998). The Relation Between Earnings and Cash Flows. *Journal of Accounting and Economics*, 25, pp. 133-168.

Dechow, P.; Hutton, A. and Sloan, R. (1999). An Empirical Assessment of the Residual Income Valuation Model. *Journal of Accounting and Economics* 26, pp. 1–34.

Dechow, P. and Dichev, I. (2002). The Quality of Accruals and Earnings: The Role of Accrual Estimation Errors. *The Accounting Review*, 77, pp. 35-59.

Dechow, P. and Schrand, C. (2004). *Earnings Quality*. Research Foundation of CFA Institute.

Dechow, P.; Weili, Ge and Schrand, C. (2010). Understanding Earnings Quality: A Review of the Proxies, their Determinants and their Consequences. *Journal of Accounting and Economics*, 50, pp. 344-401.

Dhaliwal, D. and Reynolds, S. (1994). The Effect of the Default Risk of Debt on the Earnings Response Coefficient. *The Accounting Review*, 69, pp. 412-419.

Easton, P. and Zmijewski, M. (1989). Cross-Sectional Variation in the Stock Market Response to Accounting Earnings Announcements. *Journal of Accounting and Economics*, 11, pp. 117-141.

Fama, E. and French, K. (2000). Forecasting Profitability and Earnings. *The Journal of Business*, 73 (2), pp. 161-175.

Farinha, J. and Moreira, J. (2007). Dividends and Earnings Quality: The Missing Link. *Working paper, Research Center on Industrial, Labour and Managerial Economics (CETE). Faculty of Economics, University of Porto*.

FASB, 1978. *Statements of Financial Accounting Concepts, n.º1, Objectives of Financial Reporting by Business Enterprises*. Stanford, C.T., Financial Accounting Standard Board (FASB).

FASB, 1980. *Statements of Financial Accounting Concepts, n.º2, Qualitative Characteristics of Accounting Information*. Stanford, C.T., Financial Accounting Standard Board (FASB).

FASB, 2010. *Statements of Financial Accounting Concepts, n.º8, Conceptual Framework for Financial Reporting*. Financial Accounting Standard Board (FASB).

Feltham, G. and Ohlson, J. (1995). Valuation and Clean Surplus Accounting for Operating and Financial Activities. *Contemporary Accounting Research*, 11, pp. 689–732.

Feltham, G. and Ohlson, J. (1996). Uncertainty Resolution and the Theory of Depreciation Measurement. *Journal of Accounting Research*, 34, pp. 209–234.

Feltham, G. and Ohlson, J. (1999). Residual Earnings Valuation with Risk and Stochastic Interest Rates. *The Accounting Review*, 74 (2), pp. 165-183.

Figueiredo, M. and Hill, M. (2003). Dados em Painel: Painéis Genuínos vs Pseudo Painéis Vantagens e Limitações. *Métodos Quantitativos*, 3, Edições Sílabo.

Francis, J. and Krishnan, J. (1999). Accounting Accruals and Auditor Reporting Conservatism. *Contemporary Accounting Research*, 16 (1), pp. 135-165.

Francis, J. and Schipper, K. (1999). Have Financial Statements Lost Their Relevance? *Journal of Accounting Research*, 37, pp. 319-352.

Francis, J.; LaFond, R.; Olsson, P. and Schipper, K. (2004). Costs of Equity and Earnings Attributes. *The Accounting Review*, 79, pp. 967-1010.

Francis, J.; LaFond, R.; Olsson, P. and Schipper, K. (2005). The Market Pricing of Accruals Quality. *Journal of Accounting and Economics*, 39, pp. 295-327.

Frankel, R. and Lee, C. (1998). Accounting Valuation, Market Expectation, and the Book-to-Market Effect. *Journal of Accounting and Economics*, 25 (3), pp. 283-319.

Freeman, R. N. (1987). The Association Between Accounting Earnings and Security Returns for Large and Small Firms. *Journal of Accounting and Economics,* 9, pp. 195-228.

Landsman, W.; Maydew, E. and Thornock, J. (2009). The Information Content of Annual Earnings Announcements and Mandatory Adoption of IFRS. *SSRN Working Paper Series*, *February version*.

Lara, J.; Grambovas, C. and Walker, M. (2009). On the Developmentof an Efficient Deflator for the Estimation of Accounting-Based Valuation Models. *SSRN Working Paper Series*, *April version*.

Liu, J.; Nissim, D. and Thomas, J. (2002). Equity Valuation Using Multiples. *Journal of Accounting Research*, 40 (1), pp. 135-172.

Lee, Y. (2004). Earnings Quality, Disclosure Level and the Firm's Cost of Equity Capital. *Working paper*, *Michigan State University*.

Gama, A. (2006). *A Relação entre Perdas e Valor no Contexto de um Sector Emergente: O Caso das Empresas Americanas da Nova Economia*. Tese de doutoramento, Instituto Superior de Ciências do Trabalho e da Empresa.

Gaio, C. and Raposo, C. (2010). Earnings Quality and Firm Valuation: International Evidence. *Accounting and Finance*, 51 (2), pp. 467-499.

Givoly, D. and Hayn C. (1993). Transitory Accounting Items: Information Content and Earnings Management. *Working Paper, Northwestern University*.

Givoly, D. and Hayn C. (2000). The Changing Time-Series Properties of Earnings, Cash Flows and Accruals: Has Financial Reporting Become More Conservative? *Journal of Accounting and Economics*, 29 (3), pp. 287-320.

Ghosh, A. and Moon, D. (2005). Auditor Tenure and Perceptions of Audit Quality. *The Accounting Review*, 80 (2), pp. 585-612.

Ghosh, A.; Gu, Z. and Jain, P. (2005). Sustained Earnings and Revenue Growth, Earnings Quality, and Earnings Response Coefficients. *Review of Accounting Studies*, 10, pp. 33-57.

González, C. (1998). *Una Evaluación Empírica de la Calidad del Resultado. Departamento de Economía Financiera y Contabilidad*. Universidad de Extremadura.

Gonedes, N. (1975). Risk, Information and the Effects of Special Accounting Items on Capital Market Equilibrium. *Journal of Accounting Research*, 13, pp. 220-256.

Graham, J.; Harvey, C. and Rajgopal, S. (2005). The Economic Implications of Corporate Financial Reporting. *Journal of Accounting and Economics*, 40 (1-3), pp. 3-73.

Greene, W. (2008). *Econometric Analysis*. 6th edition. Pearson Prentice Hall.

Guay, W. R.; Kothari, S. P. and Watts, R. L. (1996). A Market-Based Evaluation of Discretionary Accrual Models. *Journal of Accounting Research*, 34, pp. 83-105.

Gujarati, D. (2008). *Basic Econometrics*. 4th edition, McGraw-Hill.

Hail, L. and Leuz, C. (2007). Capital Market Effects of Mandatory IFRS Reporting in the EU: Empirical Evidence. *Working Paper, University of Pennsylvania*.

Hand, J. (1989). Did Firms Undertake Debt-Equity Swaps for an Accounting Paper Profit or True Financial Gain? *The Accounting Review*, 64, pp. 587–623.

Hand, J. and Landsman, W. (1999). The Pricing of Dividends and Equity Valuation. *Working Paper, University of North Carolina*.

Hand, J. (2001). Discussion of Earnings, Book Values, and Dividends in Equity Valuation: An Empirical Perspective. *Contemporary Accounting Research*, 18, pp. 121-130.

Hayn, C. (1995). The Information Content of Losses. *Journal of Accounting and Economics*, 20, pp. 125-153.

Healy, P. (1985). The Effect of Bonus Schemes on Accounting Decisions. *Journal of Accounting and Economics*, 7 (1-3), pp. 85-107.

Hermanns, S. (2006). Financial Information and Earnings Quality. *Working Paper, Facultes Universitaires Notre-Dame de la Paix.*

Hill, M. and Hill, A. (2000). *Investigação por questionário*. Lisboa: Edições Sílabo.

Hoskin, R.; Hughes, J. and Ricks, W. (1986). Evidence on the Incremental Information Content of Additional Firm Disclosures Made Concurrently with Earnings. *Journal of Accounting Research*, 24, pp. 1-32.

Hsiao, C. (1985). Benefits and Limitations of Panel Data. *Econometric Reviews*, 4, pp. 121-174.

Hunt, A.; Moyer, S. and Shevlin, T. (1996). Managing Interacting Accounting Measures to Meet Multiple Objectives: A Study of LIFO Firms. *Journal of Accounting and Economics*, 21, pp. 339–374.

Hunt, A.; Moyer, S. and Shevlin, T. (2000). Earnings Volatility, Earnings Management and Equity Value. *Working paper, University of Washington*.

IASC, 1989. *Framework for the Preparation and Presentation of Financial Statements*. London, International Accounting Standards Commitee (IASC).

Imhoff, E. and Thomas, J. (1989). *Accounting Quality*. *Working paper, University of Michigan*.

Jacobsen, R. (1988). The Persistence of Abnormal Returns. *Strategic Management Journal*, 9, pp. 415-430.

Jones, J. (1991). Earnings Management During Import Relief Investigations. *Journal of Accounting Research*, 29, pp. 193-228.

Joos, P. and Lang M. (1994). The Effects of Accounting Diversity: Evidence from the European Union. *Journal of Accounting Research*, 32, pp. 141-168.

Kaiser, H. F. and Rice, J. (1974). Little Jiffy Mark IV. *Educational and Psychological Measurement*, 34, pp. 111-117.

Kormendi, R. and Lipe, R. (1987). Earnings Innovations, Earnings Persistence, and Stock Returns. *Journal of Business*, 60, pp. 323-345.

Kothari, S. (1992). Price-Earnings Regressions in the Presence of Prices Leading Earnings. *Journal of Accounting and Economics*, 15, pp. 173-202.

Kothari, S. and Zimmerman, J. (1995). Price and Return Models. *Journal of Accounting and Economics*, 20, pp. 155–192.

Kothari, S. (2001). Capital Markets Research in Accounting. *Journal of Accounting and Economics*, 31, pp. 105-231.

Kothari, S.; Leone, A. and Wasley, C. (2005). Performance Matched Discretionary Accrual Measures. *Journal of Accounting and Economics*, 39, pp. 163–197.

Lee, C.; Myers, J. and Swaminathan, B. (1999). What Is the Intrinsic Value of the Dow?. *Journal of Finance*, 54, pp. 1693–1741.

Leuz, C.; Nanda, D. and Wisocki, P. (2003). Investor Protection and Earnings Management: An International Comparison. *Journal of Financial Economic*s, 69, pp. 505-527.

Lev, B. (1983). Some Economic Determinants of the Time-Series Properties of Earnings. *Journal of Accounting and Economics*, 5, pp. 31-38.

Lev, B. (1989). On the Usefulness of Earnings and Earnings Research: Lessons and Directions from Two Decades of Empirical Research. *Journal of Accounting Research*, 27, Supplement, pp. 153-192.

Lev, B. and Zarowin, P. (1999). The Boundaries of Financial Reporting and How to Extend Them. *Journal of Accounting Research*, 37 (2), pp. 353-385.

Levitt, A., 1998. *The "Numbers Game"*. Remarks by Chairman Arthur Levitt to the New York University Center for Law and Business. September, 28. URL: http://www.sec.gov/news/speech/speecharchive/1998/spch.txt.

Lipe, R. (1986). The Information Contained in the Components of Earnings. *Journal of Accounting* Research, 24, pp. 37–64.

Lipe, R. (1990). The Relation Between Stock Returns and Accounting Earnings Given Alternative Information. *The Accounting Review*, 65, pp. 49-71.

Liu, J.; Nissim, D. and Thomas, J. (2002). Equity Valuation Using Multiples. *Journal of Accounting Research*, 40, pp. 135-172.

Lo, K. and Lys, T. (2001). The Ohlson Model: Contribution to Valuation Theory, Limitations, and Empirical Applications. *Journal of Accounting Auditing & Finance*, 15 (3), pp. 337-367.

Lundholm, R. J. (1995). A Tutorial on the Ohlson and Feltham-Ohlson Models: Answers to Some Frequently Asked Questions. *Contemporary Accounting Research*, 11, pp. 749-761.

Marques, L. (2000). *Modelos Dinâmicos com Dados em Painel: Revisão da Literatura*. Documento de trabalho, Centro de Estudos Macroeconómicos e Previsão, Faculdade de Economia do Porto, Porto.

Maroco, J. (2003). *Análise Estatística - Com Utilização do SPSS* . Lisboa: Edições Sílabo.

McNichols, M. (2002). Discussion of the Quality of Accruals and Earnings: The Role of Accrual Estimation Errors. *The Acounting Review*, 77, pp. 61-69.

Mendes, C.; Rodrigues, L. and Esteban, L. (2011). Os *Accruals* como Instrumento de Manipulação de Resultados: Modelos de Accruals Agregados. *Tékhne,* 9 (16), pp. 31-65.

Miller, M. and Modigliani, F. (1961). Dividend Policy, Growth and the Valuation of Shares. *Journal of Business,* 34 (4), pp. 411–433.

Modigliani, F. and Miller, M. (1958). The Cost of Capital, Corporate Finance and the Theory of Investment. *American Economic Review*, 48 (3), pp. 261-297.

Mota, G.; Nunes, J. and Ferreira, M. (2004). *Finanças Empresariais – Teoria e Prática*. Publisher Team.

Myers, J. (1999). Implementing Residual Income Valuation with Linear Information Dynamics. *The Accounting Review*, 74, pp. 1–28.

Myers, J.; Myers, A. and Omer, T. C. (2003). Exploring the Term of the Auditor-Client Relationship and the Quality of Earnings: A Case for Mandatory Auditor Rotation. *The Accounting Review*, 78, pp. 779-798.

Ohlson, J. and Zhang, X. (1998). Accrual Accounting and Equity Valuation. *Journal of Accounting Research,* 36, pp. 85-111.

Ohlson, J. (1995). Earnings, Book Values and Dividends in Equity Valuation. *Contemporary Accounting Research*, 11 (2), pp. 661-687.

Ohlson, J. (1999). On Transitory Earnings. *Review of Accounting Studies*, 3, pp. 145–162.

Ohlson, J. (2001). Earnings, Book Values and Dividends in Equity Valuation: An Empirical Perspective. *Contemporary Accounting* Research, 3, pp. 107-120.

Peasnell, K. V.; Pope, P. F. And Young, S. (2000). Detecting Earnings Management Using Cross-Sectional Abnormal Accruals Models. *Journal of Accounting and Business Research,* 30 (4), pp. 313-326.

Penman, S. (1998). Combining Earnings and Book Value in Equity Valuation. *Contemporary Accounting Research*, 15, pp. 291-324.

Penman, S. (2001). *Financial Statement Analysis and Security Valuatio*n. New York: McGraw Hill/Irwin.

Penman, S. and Zhang, X. (2002). Accounting Conservantism, the Quality of Earnings, and Stock Returns. *The Accounting Review,* 77(2), pp. 237-264.

Pestana, M. H. and Gageiro, J. N. (2005). *Análise de Dados para Ciências Sociais – A Complementaridade do SPSS.* 4ª edição. Lisboa: Edições Sílabo.

Pope, P. and Walker, M. (1999). International Differences in the Timeliness, Conservatism and Classification of Earnings. *Journal of Accounting Research,* 37, pp. 53-99.

Ramakrishnan, R.T.S. and Thomas, J.K. (1998). Valuation of Permanent, Transitory and Price-Irrelevant Components of Reported Earnings. *Journal of Accounting, Auditing and Finance*, 13 (3).

Ramesh, K. and Thiagarajan, S. (1993). Estimating the Permanent Component of Accounting Earnings Using the Unobservable Components Model: Implications for Price-Earnings Research. *Journal of Accounting, Auditing and Finance*, pp. 399-425.

Raonic, I.; McLeay, S. and Asimakopoulos, I. (2004). The Timeliness of Income Recognition by European Companies: An Analysis of Institucional and Market Complexity. *Journal of Business Finance and Accounting*, 31, pp. 115-148.

Rayn, S. (1995). A Model of Accrual Measurement with Implications for Future Profitability, Risk and Market Value. *Review of Accounting Studies*, 33, pp. 95-112.

Revsine, L.; Collins, D. and Johnson, B. (2002). *Financial Reporting and Analysis*. Prentice Hall, Upper Saddle River, New Jersey.

Richardson, S. (2003). Earnings Quality and Short Sellers. *Accounting Horizons*, Supplement: pp. 49-61

Richardson, S.; Sloan, R.; Soliman, M. and Tuna, I. (2005). Accrual Reliability, Earnings Persistence and Stock Prices. *Journal of Accounting and Economics*, 39, pp. 437-485.

Richardson, S.; Sloan, R.; Soliman, M. and Tuna, I. (2006). The Implications of Accounting Distortions and Growth for Accruals and Profitability. *The Accounting Review*, 81 (3), pp. 713-743.

Riley, R. A.; Pearson, T. A. and Trompeter, G. (2003). The Value Relevance of Non-financial Performance Variables and Accounting Information: The Case of the Airline Industry. *Journal of Accounting and Public Policy*, 22 (3), pp. 231-254.

Runyon, R. P.; Haber, A.; Pittenger, D. J. and Coleman, K. A. (1996). *Fundamentals of Behavioral Statistics*. New-York, McGraw-Hill.

Schipper, K. and Vincent, L. (2003). Earnings Quality. *Accounting Horizons*, supplement, pp. 97-110.

Scholer, F. (2004). The Quality of Accruals and Earnings and the Market Pricing of Earnings Quality. *Working Paper, Aarhus School of Business*.

Sercu, P.; Vander Bauwhede, H. and Willekens, M. (2002). Earnings Quality in Privately Held Firms: The Roles of External Audits, Stakeholders, and Governance Mechanisms. *Working Paper, Katholieke Universiteit Leuven (KUL).*

Sloan, R. (1996). Do Stock Prices Fully Reflect Information in Accruals and Cash Flows about Future Earnings? *The Accounting Review*, 71, pp. 289-315.

Stober, T. L. (1992). The Incremental Information Content of Receivables in Predicting Sales, Earnings, and Profit Margins. *Journal of Accounting, Auditing and Finance*, 30, pp. 447–473.

Subramanyan, K. and Wild, J. (1993). The Going Concern Assumption and the Informativeness of Earnings. *Working paper, University of Wisconsin*.

Thomas, J. and Zhang, X. (2000). Identifying Unexpected Accruals: A Comparison of Current Approaches. *Journal of Accounting and Public Policy*, 19, pp.347-376.

Thomas, J. and Zhang, H. (2001). Inventory Changes and Future Returns. *The Review of Accounting Studies*, 7, pp.163-187.

Thomas, J. and Zhang, H. (2002). Value-Relevance Properties of Smoothed Earnings. *Working Paper, Columbia University and University of Illinois at Chicago*.

Tucker, J. and Zarowin, P. (2006). Does Income Smoothing Improve Earnings Informativeness? *The Accounting Review*, 81, pp. 251-270.

Vuong, O. H. (1989). Likelihood Ratio Tests for Model Selection and Non-Nested Hypothesis, *Econometrica*, pp. 307-333.

Warfield, T.; Wild, J. and Wild, K. (1995). Managerial Ownership, Accounting Choices, and Informativeness of Earnings. *Journal of Accounting and Economics*, 20, pp. 61-91.

Watts, R. (2003a). Conservatism in Accounting. Part I: Explanations and Implications. *Accounting Horizons*, 17, pp. 207-221.

Watts, R. (2003b). Conservatism in Accounting. Part II: Evidence and Research Opportunities. *Accounting Horizons*, 17, pp. 287-301.

Watts, R. And Leftwich, R. (1977). The Time Series of Annual Accounting Earnings. *Journal of Accounting Research*, 15, pp. 253-271.

Williams, P. (2005). The Effect of Pension Income on the Quality of Corporate Earnings: IBM, a Case Study. *Issues in Accounting Education*, 20 (2), pp. 167-1.

Wooldridge, J.M. (2003). *Econometric Analysis of a Cross Section and Panel Data*. MIT Press, Cambridge.

Wooldridge, J.M. (2003). *Introductory Econometrics: A Modern Approach*. 2nd edition, South-Western College Publishing, Cincinnati.

Wysocki, P. (2006). Assessing Earnings and Accruals Quality: U.S. and International Evidence. *Working Paper, MIT Sloan School of Management*.

Young, S. (1999). Systematic Measurement Error in the Estimation of Discretionary Accruals: An Evaluation of Alternative Modelling Procedures. *Journal of Business Finance and Accounting*, 26 (7-8), pp. 833-862.

2 – Indirect references

Ball, R. and Brown, P. (1968). An Empirical Evaluation of Accounting Income Numbers. *Journal of Accounting Research*, October, pp. 159-178, *apud* AAVV[45].

Ball, R. and Watts, R. (1972). Some Time Properties of Accounting Income. *Journal of Finance*, 27, pp. 663-681, *apud* AAVV.

Beaver, W. and Demski, J. (1979). The Nature of Income Measurement. *Accounting Review*, January, pp. 38-46, *apud* AAVV.

Beaver, W.; Lambert, R. and Morse, D. (1980). The Information Content of Security Prices. *Journal of Accounting and Economics*, 2, pp. 3-28, *apud* AAVV.

Bryman A. and Cramer, D. (1993). *Análise de Dados em Ciências Sociais. Introdução às Técnicas Utilizando o SPSS*. Oeiras: Celta, *apud* Pestana and Gageiro (1998).

Canning, J. (1929). *The Economics of Accountancy*. New York. The Ronald Press Company, *apud* AAVV.

Cronbach, L. and Meehl, P. (1955). Construct Validity in Psychological Tests. *Psychological Bulletin*, 52, pp. 281–302, *apud* AAVV.

Edey, H. (1957). Business Valuation, Goodwill and the Super-Profit Method. *Accountancy,* January, *apud* AAVV.

Edwards, E. O. and Bell, P. W. (1961). The Theory of and Measurement of Business Income. *University of California Press*, *apud* AAVV.

Fama, E. and Miller, M. (1972*). The Theory of Finance.* New York, Rinehand S. Winston, *apud* AAVV.

Gordon, M. and Shapiro, E. (1956). Capital Equipment Analysis: The Required Rate of Profit. *Management Science,* 3, pp. 102-110, *apud* AAVV.

Hausman, J. A. (1978). Specification Tests in Econometrics. *Econometrica,* 46, pp. 1251-1272, *apud* Greene (2008).

Hicks, J. (1939). *Value and Capital*. Oxford University Press, *apud* AAVV.

Ohlson, J. (1988). Accounting Earnings, Book Value and Dividends. The Theory of the Clean Surplus Equation. *Working paper, Columbia University*, *apud* AAVV.

---

[45] AAVV: several of the direct references.

Peasnell, K. V. (1981). On Capital Budgeting and Income Measurement. *Abacus*, 17, pp. 52-67, *apud* AAVV.

Peasnell, K. V. (1982). Some Formal Connections Between Economic Values and Yields and Accounting Numbers. *Journal of Business Finance and Accountancy*, 9, pp. 361-381, *apud* AAVV.

Preinreich, G. (1938). Annual Survey of Economic Theory: The Theory of Depreciation. *Econometrica*, 6, pp. 219-231, *apud* AAVV.

Ronen, J. and Sadan, S. (1981). *Smoothing Income Numbers: Objectives, Means and Implications*. Addison-Wesley, Reading, MA, *apud* AAVV.

Stigler, G. (1963). *Capital and Rates of Return in Manufacturing Industries*. Princeton, N.J.. Princeton University Press, *apud* AAVV.

Theil, H. (1961). Economic Forecasts and Policy. 2^{sd} edition. Amsterdam, North-Holland, *apud* Greene (2008).

Williams, J. B. (1938). The Theory of Investment Value. *Harvard University Press*, Cambridge Mass, *apud* AAVV.

APPENDICES

Appendix 1 – Variables description

Variable	Definition
Net sales or revenues (WS[46] 01001)	NET SALES OR REVENUES (REV) represents gross sales and other operating revenue less discouts, returns and allowances
Depreciation, depletion and amortization (WS 01151)	DEPRECIATION (DEP) represents the process of allocating the cost of a depreciable asset to the accounting periods covered during its expected useful life to a business. It is a non-cash charge for use and obsolescence of an asset. DEPLETION refers to cost allocation for natural resources such as oil and mineral deposits. AMORTIZATION relegates to cost allocation for intangible assets such as patents and leasehold improvements, trademarks, bookplates, tools and film cost.
Net income before extraordinary item/preferred dividends (WS 01551)	NET INCOME BEFORE EXTRAORDINARY ITEMS/PREFERRED DIVIDENDS (NI) represents income before extraordinary items and preferred and common dividends, but after operating and non-operating income and expenses, reserves, income taxes, minority interests and equity in earnings.
Cash & equivalents - generic (WS 02005)	CASH & EQUIVALENTS – GENERIC (CASH) represents cash and due from banks for banks, cash and short term investments for all other industries. This item is available in the annual time series and the quarterly, semiannual and trimester interim time series. It is only available at the company level.
Receivables (net) (WS 02051)	RECEIVABLE (REC) represents the amounts due to the company resulting from the sale of goods and services on credit to customers (after applicable reserves). These assets should reasonably be expected to be collected within a year or within the normal operating cycle of a business.
Inventories – Total (WS 02101)	INVENTORIES (INV) represent tangible item or merchandise net of advances and obsolescence acquired for either (1) resale directly or (2) included in the production of finished goods manufactured for sale in the normal course of operation. In the manufacturing companies this item is classified as follows (depending upon the stage of competition in the manufacturing process).
Current assets – total (WS 02201)	CURRENT ASSETS (CA) represents cash and other assets that are reasonablyexpected to be realized in cash, sold or consumed within one year or one operating cycle.
Property, plant and equipment – gross	PROPERTY, PLANT AND EQUIPMENT (PPE) represents tangible assets with an expected useful life of over one year which are expected to

[46] In all variables considered, we present the World Scope item (WS).

Appendix 1 – Variables description

Variable	Definition
(WS 02301)	be used to produce goods for sale or for distribution of services.
Total assets (WS 02999)	TOTAL ASSETS (TA) represent the sum of total current assets, long term receivables, investment in unconsolidated subsidiaries, other investments, net property plant and equipment and other assets.
Accounts payable (WS 03040)	ACCOUNTS PAYABLE (PAY) represents the claims of trade creditors for unpaid goods or services, which are due within the normal operating cycle of the company.
Short Term debt & current portion of long term debt (WS 03051)	SHORT TERM DEBT & CURRENT PORTION OF LONG TERM DEBT (STDEBT) represents that portion of debt payable within one year including current portion of long term debt and sinking fund requirements of preferred stock of debentures.
Current Liabilities – Total (WS 03101)	CURRENT LIABILITIES represent debt or other obligations that the company expects to satisfy within one year.
Long Term Debt (WS 03251)	LONG TERM DEBT represents all interests bearing financial obligations, excluding amounts due within one year. It is shown net of premium or discount.
Total Liabilities (WS 03351)	TOTAL LIABILITIES represents all short and long term obligations expected to be satisfied by the company.
Common Equity (WS 03501)	COMMON EQUITY (BVE) represents common shareholders' investment in a company.
Total Shareholder's Equity (WS 03995)	TOTAL SHAREHOLDER'S EQUITY represents the sum of Preferred Stock and Common Shareholders Equity. This item is available in the annual time series and the quarterly, semiçannual and trimester interim time series. It is only available at the company level.
Total liabilities and shareholders' equity (WS 03999)	TOTAL LIABILITIES AND SHAREHOLDER'S EQUITY represents the sum of total liabilities, minority interest, non-equity reserves, preferred stock and common equity.
Funds from operations (WS 04201)	FUNDS FROM OPERATIONS (CFO) represents the sum of the net income and all non-cash charges or credits. It is the cash flow of the company. If a statement of changes in financial position has not been provided, but the company discloses an aggregate cash flow, this amount has been used. Where cash flow has not been disclosed in any manner, it is estimated based on net profit before dividends plus depreciation, reserves charges, provision for loan losses for banks, and provision for future benefits for insurance companies.
Market prices – monthly close – (WS 05025)	MARKET PRICE – MONTHLY CLOSE represents the closing price of the stock at its respective month end.

Appendix 1 – Variables description

Variable	Definition
Common shares outstanding (WS 05301)	COMMON SHARES OUTSTANDING represent the number of shares outstanding at the company's year end. It is the difference between issued shares and treasury shares.
Market capitalization (WS 08001)	Market capitalization represents the total market value of the company or market value equity (MVE). Market Price-Year End * Common Shares Outstanding.

Appendix 2 – Definition of accruals and different types of accruals

Concept	Author	Definition
Total Accruals (Normal Accruals)	Butler *et al.* (2004)	Total accruals are earnings before extraordinary items and discontinued operations minus operating cash flows from continuing operations.
	Sercu *et al.* (2002)	Total accruals are computed as working capital accruals minus depreciation.
	Ahmed *et al.* (2004)	Total accruals are obtained by making the difference between income (before extraordinary items and discontinued operations) and operating cash flows.
	Jones (1991)	Normal accruals of the Jones Model are the accruals that the average firm with the same characteristics would have shown. The residual therefore is the measure of discretionary accruals.
Current accruals	McNichols (2002); Myers *et al.* (2003)	Current accruals recognized in period t are equal to the recognition of cash flows realized in t-1 and to be realized in t+1 minus the sum of cash flows realized in period t but to be recognized in t+1 or being recognized in t-1 plus the estimation error in period t's opening accrual that will be realized in t+1 and minus the closing error for period t-1 realized in period t. According to Myers *et al.* (2003) those are equal to (change in current assets – change in cash and cash equivalents) – (change in current liabilities – change in short-term notes and current portion of long term debt).
Operating accruals	Richardson (2003)	Operating accruals are the current operating accruals less depreciation and amortization expense.
Total net accruals	Richardson *et al.* (2005 and 2006)	Total net accruals are equal to net income – cash from operating activities – cash from investing activities – cash from financing activities. Total net operating accruals can be split up in a current and a non-current part. It is the change in net operating assets or also net income – cash from operating activities – cash from investing activities.
Abnormal Accruals or Extreme Accruals or Discretionary Accruals	DeAngelo (1986)	Abnormal total accruals is the difference between current total accruals and normal total accruals (and both can be split up in a discretionary and non discretionary part).
	Guay *et al.* (1996)	Abnormal accruals or discretionary accruals are the same.

Appendix 2 – Definition of accruals and different types of accruals

Concept	Author	Definition
	Francis *et al.* (2005)	Abnormal accruals are accruals introduced by management to achieve specific earnings outcomes. Abnormal accruals are a synonym for discretionary accruals.
Working capital accruals	Richardson *et al.* (2005 and 2006)	Working capital accruals are in general short-term accruals. They exclude the components for depreciation and other long-term charges. Those accruals are equal to the increase in accounts receivable + the increase in inventory + decrease in accounts payable and accrued liabilities + decrease in income taxes accrued + increase (decrease) in assets (liabilities) – other.
Accruals relating to financing activities	Richardson *et al.* (2005 and 2006)	Accruals relating to financing activities are financial obligations and involve deferrals of past cash inflows and are carried at cost. They involve little subjective judgment and are inherently reliable.
Accruals relating to investing activities	Richardson *et al.* (2005 and 2006)	Accruals relating to investing activities relate to the operating activities of the firm and more specifically to expenditures that provide productive capacity rather than to expenditures that directly produce a good or service. Those accruals typically involve the capitalisation of cash outflows relating to capital expenditures, development costs, business acquisitions and long-term loans.
Assets and liabilities accruals	Francis and Krishnan (1999); Richardson *et al.* (2005 and 2006)	Assets and liabilities accruals relate to a balance sheet categorization: – **Asset accruals** are rather subjective and examples include allowance on receivables, write-off of obsolete inventory and depreciation schedule for PP&E. Examples of asset accruals: allowance on receivables, the write-off of obsolete inventory and the depreciation schedule for PP&E (Richardson *et al.*, 2005 and 2006). – **Liability accruals** are far less subjective but some of them include nevertheless a subjective judgment like for example advance payments and warranty liabilities. In general they provide less direct information about earnings quality. Examples of liability accruals include bad debt, loan loss reserves, pension costs, leases, contingent liabilities (Francis and Krishnan, 1999).

Appendix 2 – Definition of accruals and different types of accruals

Concept	Author	Definition
		The most common liabilities accruals represent future financial obligations such as accounts payable, accrued liabilities, taxes payable, pension obligations. But there are also non-financial obligations like warranty liabilities and advance payments.
Performance-adjusted abnormal accruals	Ahmed *et al.* (2004)	Performance-adjusted abnormal accruals are equal to the difference between a firm's abnormal accruals and the median value of abnormal accruals for its industry return-on-assets decile. Negative as well as positive values of those abnormal accruals indicate a greater disparity between earnings and accounting (economic) fundamentals. Ahmed *et al.* (2004) obtains those accruals by taking the residual from the cross-sectional modified Jones Model and subtracting the median residual from a matching portfolio based on the percentile ranking of earnings.

Components of accruals are changes in accounts receivable, changes in inventory, changes in other current assets, changes in accounts payable, changes in taxes payable, changes in other current liabilities and depreciation and other long-term charges.

Appendix 3 – Summary of earnings quality measures

Earnings Attributes	Analitic formulation	EQ's Metrics	Justification	Studies that use the same or similar indicators
• **Persistence**	**Autoregressive model of order one (AR1) for annual earnings:** [3.1] $x_{t+1} = \phi_0 + \phi_1 x_t + \varepsilon_t$	• $EQ_1 = \phi_1$. Values of ϕ_1 close to one imply highly persistent earnings, while values of ϕ_1 close to zero imply highly transitory earnings. ϕ_1 captures the persistence of earnings.	Following previous research we measure earnings persistence as the slope coefficient estimate, ϕ_1, from an autoregressive model of order one (AR1) for annual earnings.	Lev (1983); Ali and Zarowin (1992); Sloan (1996); Richardson *et al.* (2005 and 2006); Francis *et al.* (2004 and 2005); Ball and Watts (1972); Watts and Leftwich (1977); Dechow *et al.* (2010); Gaio and Raposo (2010).
	Pearson correlation between current and next period earnings: [3.4] $x_t = \sigma_1 x_{t+1}$	• $EQ_2 = \sigma_1$, values of σ_1 close to one imply highly persistent earnings, while values of σ_1 close to zero imply lower persitent. σ_1 is the firm-specific pearson correlation between current and next period earnings.	Persistence is the degree to which earnings performance persists into the next period. It can be measured as the firm-specific pearson correlation between current and next period earnings.	Wysocki (2006).
• **Predictability**	Based on Lipe (1990), one measure of earnings predictability is also derived from the firm-year specific AR1 models. Specifically, we use the square root of the error variance from equation [3.1].	• $EQ_3 = \sqrt{\hat{\sigma}^2(\varepsilon_t)}$	Large (small) values of EQ_3 imply less (more) predictable earnings.	Lipe (1990); Dechow *et al.* (2010); Gaio and Raposo (2010).
	Pearson correlation between current earnings and next period cash flow:	• $EQ_4 = \varphi_1$, values of ϕ_1 close to one imply highly	*Predictive ability* is the ability of current earnings to predict future	Wysocki (2006).

Appendix 3 – Summary of earnings quality measures

Earnings Attributes	Analitic formulation	EQ's Metrics	Justification	Studies that use the same or similar indicators
	[3.5] $x_{it} = \varphi_1 CFO_{it+1}$	predictability earnings, while values of ϕ_1 close to zero imply lower predictability. φ_1 is the firm-specific pearson correlation between current earnings and next period cash flow.	cash flow from operations. In a similar way as persistence, this tends to be measured as the firm-specific pearson correlation between current earnings and next period cash flow.	
• ***Smoothness***	We define $Smoothness_{it}$ as the ratio of firm j's standard deviation of net income before extraordinary items (x_{it}) divided by beginning assets, to its standard deviation of cash flows from operations (CFO_{it}) divided by beginning total assets.	• EQ_5 [47] = $\frac{\sigma(x_{it})}{\sigma(CFO_{it})}$ A lower ratio (lower values of $Smoothness_{it}$) indicates more smoothing of the earnings stream relative to cash flows. Smaller ratios imply more income smoothing.	Discussions of the benefits of smooth earnings include Ronen and Sadan (1981), and Chaney *et al.* (1998). Arguments that smoothness is a desirable earnings attribute derive from the view that managers use their private information about future income to smooth out transitory fluctuations and thereby achieve a more representative, hence more useful, reported earnings number. Smoothing transitory cash flows can improve earnings persistence and	Hunt *et al.* (2000) ; Thomas and Zhang (2002) ; Francis *et al.* (2004) ; Francis *et al.* (2005); Leuz *et al.* (2003); Dechow *et al.* (2010); Gaio and Raposo (2010).

[47] Our measure of smoothness is the same as in Francis *et al.* (2005), and similar to those used by Leuz *et al.* (2003) and Hunt *et al.* (2000). Leuz *et al.* (2003) examine the ratio of the standard deviation of operating income scaled by assets, to the standard deviation of cash flows from operations scaled by assets. Hunt *et al.* (2000) examine the ratio of the standard deviation of non-discretionary net income (equal to operating cash flows plus non-discretionary accruals) to the standard deviation of cash flows from operations.

Appendix 3 – Summary of earnings quality measures

Earnings Attributes	Analitic formulation	EQ's Metrics	Justification	Studies that use the same or similar indicators
			earnings informativeness. However, managers attempting to smooth permanent changes in cash flows will lead to a less timely and less informative earnings number.	
	The correlation between changes in accruals and changes in cash flows.	• $EQ_6 = Corr(\Delta ACC_{it}, \Delta CFO_{it})$ Negative correlations are evidence of income smoothing.	The idea is that changes in cash flows capture the innovation in the unmanaged earnings series, so extreme values of the smoothing measures indicate how much volatility has been removed from the series by means of accruals taken in response to economic shocks. Leuz *et al.* (2003) suggest that the resulting smoothed earnings are less informative as a result of the noise added by management interventions.	Leuz *et al.* (2003); Dechow *et al.* (2010).
• **Informativeness of earnings**	**General Model:** [3.6] $V = f(A, v)$ Where, V - a variable representing some market measure of value; A - any vector of accounting variables, such as earnings per share; v - any vector of information other than information in accounting numbers.	• The earnings response coefficient (EQ_7, EQ_8, EQ_9) indicates the relative change in stock price when earnings-per-share varies a monetary unit. The measure of earnings is deflated by the stock price at the end of fiscal year, in order to	In this scenario, the earnings response coefficient (ERC) has been used as a measure of earnings quality. Prior research demonstrates that firms with sustained increases in earnings have higher ERCs than other firms (Barth *et al*., 1999). The ERC appears as a measure of earnings information content and, in this sense, it constitutes a proxy of reported earnings quality.	Kormendi and Lipe (1987); Easton and Zmijewski (1989); Collins and Kothari (1989); Barth *et al.* (1999); Hayn (1995).

Appendix 3 – Summary of earnings quality measures

Earnings Attributes	Analitic formulation	EQ's Metrics	Justification	Studies that use the same or similar indicators
	First (1st) specification: [3.7] $RET_{it} = \alpha_0 + EQ_7 EARN_{it} + \varepsilon_{it}$ **Second (2nd) specification** [3.8] $RET_{it} = \alpha_0 + EQ_8 \Delta EARN_{it} + \varepsilon_{it}$ **Third (3rd) specification** [3.9] $RET_{it} = \alpha_0 + EQ_9 \frac{\Delta EARN_{it}}{EARN_{it-1}} + \varepsilon_{it}$	consider the firms size and to reduce the heterocedasticity that happens in this type of relationships. More informative components of earnings will have a higer EQ_7, EQ_8, EQ_9. Investors respond to information that has value implications. A higher correlation with value implies that earnings better reflect fundamental performance.	Many authors also analyze the earnings persistence through the analysis of the values of ERC. Greater earnings persistence has been shown to be associated with larger slope coefficients relating returns to earnings	
• **Relevance**	Our measure of value relevance $(Relevance)$ is based on the explained variability from the following regression of returns on the level and change in earnings: [3.22] $RET_{it} = \delta_0 + \delta_1 EARN_{it} + \delta_2 \Delta EARN_{it} + \zeta_{it}$	• $EQ_{10} = R^2_{i,equation[3.22]}$, the explanatory power (R^2) from [3.22], for each firm-year specific regression. Large (small) values of *Relevance* imply more (less) value relevant earnings. Lower values of EQ_{10} imply lower value-relevant earnings and therefore poorer earnings	Value relevance construct is often measured as the ability of earnings to explain variation in returns, where greater explanatory power is viewed as desirable. The reference construct is therefore stock price or stock return. One stream of this research interprets value relevance as a measure of usefulness (*e.g.*, Collins *et al.* (1997); Francis and Schipper (1999)). This interpretation rests on the view that value relevance measures capture combined	Collins *et al.* (1997); Francis and Schipper (1999); Bushman *et al.* (2004); Francis *et al.* (2004); Barth *et al.* (2001); Gaio and Raposo (2010).

Appendix 3 – Summary of earnings quality measures

Earnings Attributes	Analitic formulation	EQ's Metrics	Justification	Studies that use the same or similar indicators
		quality. The value relevance of earnings (that is, the ability of earnings to explain variation in returns or prices) is a desirable attribute, as it is usually seen as a direct measure of the decision usefulness of earnings. • $EQ_{11} = R^2_{j,t,equation[3.7]}$, the adjusted R^2 from equation [3.7], our measure of value relevant is based on the explanatory power of equation [3.7]. • $EQ_{12} = R^2_{j,t,equation[3.8]}$, the adjusted R^2 from equation [3.8]. • $EQ_{13} = R^2_{j,t,equation[3.9]}$, the adjusted R^2 from equation [3.9]. More value relevant earnings will have a higher R^2.	relevance and reliability, two key concepts in the FASB's conceptual framework (for an extended discussion, see Barth *et al.*, 2001).	

Appendix 3 – Summary of earnings quality measures

Earnings Attributes	Analitic formulation	EQ's Metrics	Justification	Studies that use the same or similar indicators
• **Timeliness** **Timely loss recognition (TLR)**	Our measure of timeliness is derived from reverse regressions, which use earnings as the dependent variable and returns measures as independent variables: $EARN_{it} = \alpha_0 + \alpha_1 NEG_{it} + \beta_1 RET_{it} + \beta_2 NEG_{it} * RET_{it} + \zeta_{j,t}$ [3.23] Where $NEG_{it} = 1$ if $RET_{it} < 0$ and $NEG_{it} = 0$ otherwise.	• $EQ_{14} = R^2_{j,t,equation[3.23]}$, the adjusted R^2 from equation [3.23], our measure of timeliness is based on the explanatory power of equation [3.23]. Higher values of EQ_{14} imply more timely earnings and higher earnings quality. Earnings that reflect the information incorporated in stock returns more quickly are seen by investors as being of higher quality. • $EQ_{15} = \beta_1$, there is a demand for timely loss recognition (TLR) to combat management's natural optimism. TLR represents high quality earnings.	Timeliness and conservatism, these two attributes derive from the view that accounting earnings is intended to measure economic income, defined as changes in market value of equity (see, for example, Ball *et al.*, 2000). A higher β_1 implies more timely recognition of the incurred losses in earnings.	Ball *et al.* (2000); Bushman *et al.* (2004); Raonic *et al.* (2004); Francis *et al.* (2004); Dechow *et al.* (2010); Gaio and Raposo (2010).
• **Conservatism**	Our measure of conservatism is the negative of the ratio of the coefficient on bad news to the coefficient on good news.	• $EQ_{16} = -\left(\beta_1 + \beta_2\right) / \beta_1$ Larger values of Timeliness	Conservatism differs from timeliness in that it reflects the ability of accounting earnings to differentially reflect economic	Basu (1997); Pope and Walker (1999); Givoly and Hayn (2000); Francis *et al.* (2004); Dechow *et al.* (2010); Gaio and

Appendix 3 – Summary of earnings quality measures

Earnings Attributes	Analitic formulation	EQ's Metrics	Justification	Studies that use the same or similar indicators
		and Conservatism imply less timely earnings and less conservative earnings, respectively, than do smaller values of these variables. Higher values of EQ_{16} imply lower conservative earnings and a poorer quality of earnings. Conservative accounting is expected to reveal information that managers might have incentives to hide otherwise, so investors usually see conservatism as a desirable attribute of earnings.	losses (measured as negative stock returns) and economic gains (measured as positive stock returns). The reference construct for both timeliness and conservatism is therefore stock returns, but the two constructs differ in that timeliness does not distinguish between positive and negative returns; timeliness is the explanatory power of the regression and conservatism is the ratio of slope coefficients on negative returns to slope coefficients on positive returns. Combined timeliness and conservatism are sometimes described as "transparency", a desirable attribute of accounting earnings (see, for example, Ball *et al.*, 2000).	Raposo (2010).
Accrual Quality:	Our approaches to measuring earnings quality rely on a measure of accruals. **Magnitude of accruals:** • $EQ_{17}: \; ACC_{it} = x_{it} - CFO_{it}$	Extreme accruals are low quality because they represent a less persistent component of earnings.		Dechow *et al.* (2010).
	Changes in total accruals:	High values of EQ_{18} imply higher changes in total accruals	A simple approach to measuring earnings quality as the inverse of	DeAngelo (1986).

Appendix 3 – Summary of earnings quality measures

Earnings Attributes	Analitic formulation	EQ's Metrics	Justification	Studies that use the same or similar indicators
	• $EQ_{18} = \Delta ACC_{it}$	and provide lower earnings quality.	estimates and judgments embedded in accruals is based on changes in total accruals. As long as some portion of accruals is both non-manipulated and approximately constant over time, changes in total accruals measure managerial manipulations, and provide an inverse measure of earnings quality.	
Metrics based on direct estimation of accruals-to-cash relations (Dechow and Dichev's, 2002):	**Dechow and Dichev 's(2002) model (DD-model):** [3.17] $\frac{TCA_{it}}{TA_{it}} = \varphi_0 + \varphi_1 \frac{CFO_{it-1}}{TA_{it}} + \varphi_2 \frac{CFO_{it}}{TA_{it}} + \varphi_3 \frac{CFO_{it+1}}{TA_{it}} + \varsigma_{it}$ Where, TCA_{it} is the firm i 's total current accruals in year t, $= (\Delta CA_{it} - \Delta CL_{it} - \Delta CASH_{it} + \Delta STDEBT_{it})$; $CFO_{j,t}$ is the cash flow from operations in year t, is calculated as net income before extraordinary items less total accruals (ACC_{it}), where: $ACC_{it} = \Delta CA_{it} - \Delta CL_{it} - \Delta CASH_{it} + \Delta STDEBT_{it} - DEP_{it}$	Based on cross-sectional regressions using the DD-model approach two different earnings quality metrics are defined: • EQ_{19} is the absolute value of firm i 's residual in year t, $\lvert\hat{\varsigma}_{it}\rvert$. • EQ_{20} is the standard deviation of the firm-specific residuals, $\sigma(\hat{\varsigma}_{it})$. Consistent with the construction of the other metrics, larger absolute residuals and larger standard	Dechow and Dichev 's (2002) regression model relate current accruals to past, current and future cash flows (thus the mapping of cash flows in accruals). These measures can be interpreted in the sense that when variations in accruals are not explained by (past, current or future) cash flows (thus the higher the standard deviation of the firm-specific regression residuals, the lower the earnings quality), this results in lower earnings quality and therefore lower earnings sustainability, because we see earnings quality in relations to sustainability – higher earnings quality signals that the earnings pattern is intrinsic and therefore sustainable.	Dechow and Dichev (2002) ; McNichols (2002); Francis *et al*. (2004 and 2005); Finn Scholer (2004); Wysocki (2006).

Appendix 3 – Summary of earnings quality measures

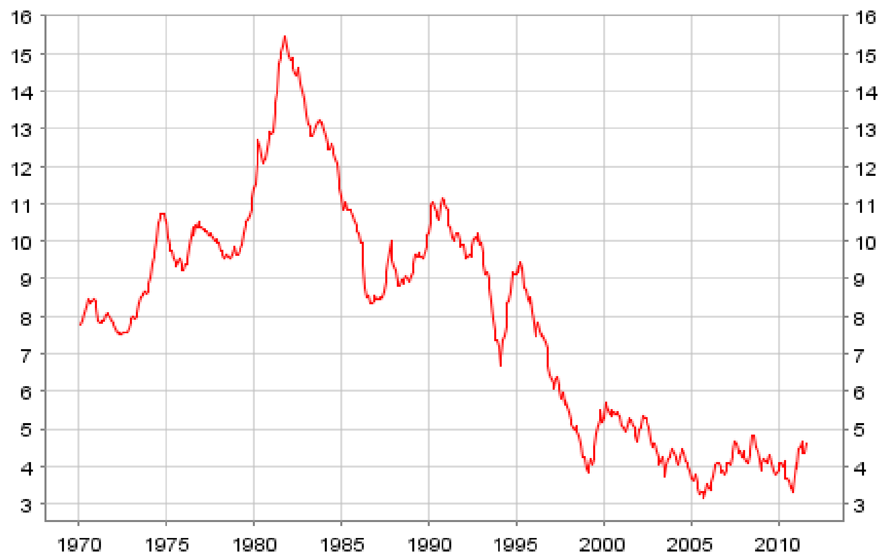
Earnings Attributes	Analitic formulation	EQ's Metrics	Justification	Studies that use the same or similar indicators
		deviations of residuals suggest poorer earnings quality.		

x_t is any measure of earnings of the several firms i for the period t, in general, the earnings level is calculated as net income before extraordinary items/preferred dividends (NI_t, WS 01551) scaled by Total Assets (TA_t, WS 02999). CFO_t is cash flows from operations of the several firms i for the period t, is the funds from operations Worldscope item (WS 04201). ACC_t is total accruals, defined as earnings (NI_t) less cash flows from operations (CFO_{it}). $RET_{it} = \frac{P_{it} - P_{it-1}}{P_{it-1}}$ is the firm j's 12-month stock return. P_{it} is the last stock price in the end of fiscal year t (WS 05025). $EARN_{it}$ is the firm i's earnings before extraordinary items in year t, scaled by market value (MVE_{it}) at the end of year $t-1$. $\Delta EARN_{it}$ is the change in firm i's earnings before extraordinary items in year t, scaled by market value (MVE_{it}) at the end of year $t-1$. MVE_{it} is the market value equity (WS 08001). ΔCA_{it} is the firm i's change in current assets between year $t-1$ and year t (current assets, WS 02201); ΔCL_{it} is the firm i's change in current liabilities between year $t-1$ and year t (current liabilities, WS 03101); $\Delta CASH_{it}$ is the firm i's change in cash between year $t-1$ and year t (cash, WS 02005); $\Delta STDEBT_{it}$ is the firm i's change in short term debt and current portion of long term debt between year $t-1$ and year t (short term debt and current portion of long term debt, WS 03051); DEP_{it} is the firm i's depreciation and amortization expense in year t (depreciation, depletion and amortization, WS 01151); ς_{it}, ε_{it} *are aleatory disturbance term;* $i = 1,...,N\ Firms;\ \ t = 1,...,T\ Period$.

Appendix 4 – Risk-free rate of interest

There is not a datatype or series specifically designated as "risk-free rate" and there are various ways of measuring it and the detailed discussion of each one of the possible focuses to determine the discount transcends the objective of this study. For example, Lara *et al.* (2009) use as a proxy for risk-free rate the constant maturity Treasury Bill rates provided by Bank of America, San Francisco (Compustat item #TBILL6M). Dechow *et al.* (1999) and Barth *et al.* (1999 and 2005) use a flat rate of 12%, Amir *et al.* (1997) use a flat rate of 10%, others athors, like Ahmed *et al.* (2000) use a risk-free rates plus a premium where they use the 12 month treasury bill rate plus a 4% risk premium, and we use the "10-year benchmark bond (euro area)" as a proxy for risk-free rate because it is the most commonly selected as a proxy for risk-free rate.

In the figure below, figure 7, we can see the 10-year benchmark bond (euro area) evolution:



Source: European Central Bank

Figure 7: Benchmark bond – 10 year government benchmark bond yield (euro area)

Appendix 5 – Derivation of valuation coefficients for linear information model

The derivation of the third linear information model (LIM3), namely equation [4.3f], in terms of the ω_{jk} in equation [4.3a] through equation [4.3e], is similar to Ohlson (1995), Myres (1999) and namely Barth *et al.* (2005)[48]. Following Ohlson (1995), market value of equity, MVE_{it}, is defined as the sum of current equity book value, BVE_{it}, and expected future abnormal earnings, NI_{it}^{a}, discounted at a constant rate, r:

$$[A.1] \qquad MVE_{it} = BVE_{it} + E_{it}\left[\sum_{t=1}^{\infty} \frac{NI_{it+\tau}^{a}}{(1+r)^{\tau}}\right].$$

In this work, we pretend to determine whether and to what extent disaggregating earnings, imposing valuation model linear information structure of accounting numbers aid in predicting contemporaneous equity values and, simultaneously, provides a composite measure of earnings quality (EQ). In order to determine whether and to what extent disaggregating earnings provides a composite measure of EQ, we need to rebuild the relation between MVE_{it}, BVE_{it} and NI_{it}^{a}, considering the persistence, in terms of sustainability of earnings, the predictability and the *informativeness* of earnings, that is, considering the earnings quality concept. In this sense, our proposal for the derivation of valuation coefficients for LIM3, that later will be developed similarly for the remaining models (LIM1 and LIM2), is:

$$[A.2] \qquad \underbrace{(MVE_{it} - BVE_{it})}_{Dif_{MBV}} = E_{t}\left[\sum_{t=1}^{\infty} \frac{NI_{it+\tau}^{a}}{(1+r)^{\tau}}\right]$$

[48] This mathematical formulation is based on the initial work of Ohlson (1995), later adapted by Barth *et al.* (2005) and now for us. Much appreciate the contributions of Professor António Alberto Santos (FEUC) for his help in mathematical formulation of this program by MATLAB software, in order to achieve our goal, which is to reformulate the mathematical formulation to obtain a composite measure of earnings quality.

As one of our objectives is to obtain a composite measure of EQ, we have to isolate the earnings variables (NI_{it}^{a}), in on the sides of the equation. In this context, the dependent variable will be a measure of the excess between the market value of equity, MVE_{it} , and the equity book value, BVE_{it} .

Define $M = \{\omega_{jk}\}$, a 5×5 matrix of the BVE_{it} coefficients in equation [4.3a] through equation [4.3e]; $X = \{\omega_{11}, \omega_{12}, ..., \omega_{15}\}$, a 1×5 row vector comprising the coefficient relating to equation [4.3a]; and $Z_{it} = \{NI_{it}^{a}, \Delta REC_{it}, \Delta INV_{it}, \Delta PAY_{it}, DEP_{it}\}$, a 5×1 column vector comprising the explanatory variables in equation [4.3f]. Using this notation, equation [4.3a] can be rewritten as $NI_{it+1}^{a} = XZ_{it}$, or, more generally, $NI_{it+\tau}^{a} = XZ_{it+\tau-1}$. Noting that $Z_{it+1} = MZ_{it}$, $NI_{it+\tau}^{a} = XZ_{it+\tau-1}$. Thus, equation [A 2] can be reexpressed as:

[A.2]’ $$\underbrace{\left(MVE_{it} - BVE_{it}\right)}_{Dif_{MBV}} = \frac{XZ_{it}}{\left(1+r\right)} + \frac{XMZ_{it}}{\left(1+r\right)^{2}} + \frac{XM^{2}Z_{it}}{\left(1+r\right)^{3}} + ...$$

[A.2]’ $$\Leftrightarrow \underbrace{\left(MVE_{it} - BVE_{it}\right)}_{Dif_{MBV}} = \frac{X}{\left(1+r\right)}\left[I + \frac{M}{(1+r)} + \frac{M^{2}}{\left(1+r\right)^{2}} + ...\right]Z_{it}$$

Assuming the eigenvalues of $\frac{X}{\left(1+r\right)}$ are all less than 1 in absolute value, then the bracketed term in equation [A2]’ equals $\left[I - \frac{M}{(1+r)}\right]^{-1}$ [49]. This implies that:

[A.3] $$\underbrace{\left(MVE_{it} - BVE_{it}\right)}_{Dif_{MBV}} = \frac{X}{\left(1+r\right)}\left[I - \frac{M}{(1+r)}\right]^{-1} Z_{it}$$

---

[49] This assumption is a generalization of the assumption in Ohlson (1995) that $\left|\omega_{jj}\right| < 1$, which ensures that time-series processes are stationary.

Defining $\beta = \{\beta_1, \beta_2, \beta_3, \beta_4, \beta_5\}$, a 1×5 row vector. Then, equation [A3] can be rewritten as:

[A.4] $$\underbrace{(MVE_{it} - BVE_{it})}_{Dif_{MBV}} = \beta Z_{it} = \left(\frac{X}{(1+r)} \left[I - \frac{M}{(1+r)} \right]^{-1} \right) Z_{it}$$

Thus,

[A.5] $$\beta = \frac{X}{(1+r)} \left[I - \frac{M}{(1+r)} \right]^{-1}$$

Absent restrictions on M (*e.g.*, triangularity of the linear information dynamics), the closed form solution for β is complex.

Appendix 6 – Panel data and estimation methods

The essential feature of panel models is to combine an approach based on time-series with a cross-section approach, which allows the use of a greater number of observations, increasing the number of degrees of freedom. It is, by definition, three-dimensional information (variables, individuals and time), combining the cross-section models (static analysis) with time-series models (dynamic analysis, but that refer just an individual). Once we have a set of data from various sectional units (2340 firms), at successive points in time (20 years), we use the panel data estimation.

This methodology was developed by several authors, and we follow, in particular, Hsiao (1985), Gujarati (2008), Baltagi (2005), Greene (2008) and Wooldridge (2002, 2003). The topic of panel data regressions is vast, and some of the mathematics and statistics involved is quite complicated. The application of panel data model is very common in studies of the acccounting and finance areas.

Building an econometric model has always as barrier the identification of all the variables that determine the dependent variable. The omission of variables, which may be important in explaining the dependent variable is an inconvenience that can be lightened by the use of panel models, admitting the existence of unobservable individual effects (random or fixed). In the regression models estimated by the least squares method, the error term includes the effect of omitted variables in the deterministic part. In the panel data methodology, the consideration of two common sources of heterogeneity – sectional and time – minimizes the problems associated with modeling, in particular, the reality simplification.

Thus, the use of panel data models are devoted mainly to study the heterogeneity on different individuals. The use of the panel data allows to extend the formulation of the model, allowing to quantify certain aspects that are difficult to quantify using only data in time-series or cross-sectional data. The use of data from different individuals (firms) reduces the risk of multicollinearity among the variables. This compatibility of the heterogeneity of individual behaviors with the temporal dynamics leads to the increase in the number of observations and the number of degrees of freedom, and it leads to econometric estimates more complete and efficient, it reduces the estimation bias, by reducing the risk of multicollinearuty and it attenuates the impact of omitted variables (Figueiredo and Hill, 2003). In short, strengthens the explanatory power of the models.

Baltagi (2005) lists the following advantages of panel data:

(1) Panel data relate to individuals, firms, states, countries, etc., over time. The techniques of panel data estimation can take such heterogeneity explicitly into account by allowing for individual-specific variables;

(2) Combining time series of cross-section observations, panel data give "more informative data, more variability, less collinearity among variables, more degrees of freedom and more efficiency" (Baltagi, 2005: 5), in short, panel data increase the sample size considerably;

(3) Studying repeated cross-section observations, panel data are better suited to study the dynamics of change;

(4) Panel data can better detect and measure effects that simply can not be observed in pure cross-section or pure time series data;

(5) Panel data enable us to study more complicated behavioral models.

In short, and according to Greene (2008: 638), "panel data can enrich empirical analysis in ways that may not be possible if we use only cross-section or time series data". However, the panel data also have some disadvantages such as the bias resulting from the heterogeneity and representativeness of the considered sample in relation to the total sample.

In the panel data models, we consider three particular cases: the "pooled regression", the fixed effects model and random effects model. The main differences between these models lie on the constant part of the model specification and the error term.

A) Pooled regression model

The pooled models are based on the assumption that all firms have the same value for the constant variable of the model, *i.e.*, these kind of models set that the parameters remain constant for different individuals and over the time.

The mathematical expression of the pooled regression models is as follows:

$$[A.6] \quad Y_{it} = \beta_0 + \beta_1 X_{1it} + \beta_2 X_{2it} + \beta_3 X_{3it} + \beta_4 X_{4it} + \beta_5 X_{5it} + \ldots + \beta_n X_{nit} + \mu_{it}$$

Equivalently and more synthetic,

$$[A.7] \quad Y_{it} = \beta_0 + \sum_{k=1}^{n} \beta_k X_{kit} + \mu_{it}$$

Where,
$i = 1, \ldots, N$ (number of sectional units); $t = 1, \ldots, T$ (number of time periods); $k = 1, \ldots, n$ (number of variables) and NT is the total number of observations. Y_{it} is the value of the dependent variable for the firm i in time period t; β_0 is the constant variable in the model; β_k is the regression coefficient of the independent variable k ($k = 1, \ldots, n$); X_{kit} is the value of independent variable k for the firm i in the year t; μ_{it} is the stochastic part, this is, the error term for the firm i during the year t.

As mentioned previously, this model is based on the assumption that the parameters β_0 and β_k are constant and, considering the homogeneity of the individuals characteristics over the time. It is the simplest model, in that it assumes that individuals have identical structures, ignoring the heterogeneity. The model is estimated by applying the method of ordinary least squares (OLS) since it satisfies the assumptions of the classical linear regression model, which is known as the pooled ordinary least squares (OLS), *i.e.*, it assumes that the errors μ_{it} follow a normal distribution with zero mean and constant variance (homoscedasticity hypothesis), are independent (no autocorrelation of errors) and are not correlated with the regressors $\left[Cov\left(X_{kit}, \mu_{it}\right) = 0\right]$.

However, by failing to account for the heterogeneity it may exist, the model suffers from specification error and biases will be greater. By ignoring the existence of heterogeneity in the data, the application of pooled ordinary least squares (OLS) is not really a panel estimation method.

B) Fixed effects model

In order to circumvent the limitations of the pooled regressions, it is appropriate to use alternative techniques that take into account the unobservable individual effects, considering in the first instance, fixed effects (regression) model[50], or model with *dummy* variables individuals.

One way to take into account the "individuality" of each firm or each cross-sectional unit is to let the intercept vary for each firm but still assume that the slope coefficients are constant across firms.

For models with fixed effects, the applicable notation is:

$$[A.8] \quad Y_{it} = \beta_{0i} + \beta_1 X_{1it} + \beta_2 X_{2it} + \beta_3 X_{3it} + \beta_4 X_{4it} + \beta_5 X_{5it} + ... + \beta_n X_{nit} + \mu_{it}$$

Equivalently and more synthetic,

$$[A.9] \quad Y_{it} = \beta_{0i} + \sum_{k=1}^{n} \beta_k X_{kit} + \mu_{it}$$

[50] According to Marques (2000), the notation "Fixed Effects" is often used exclusively for this type of model, although it should be applied to all models in which the parameters (independent term and the coefficient associated with explanatory variables) are "variables" of individual to individual, but not in a random form.

The fixed effects model considers the coefficients of the independent variables are identical for all individuals, except the independent term, β_{0i}, which specificity allows to measure individual differences. The introduction of the individual heterogeneity is made through the constant part, which, however, is invariante over time. Notice that we have put the subscript i on the intercept term to suggest that the intercepts of the four firms may be different, the differences may be due to special features of each company, such as managerial style or managerial philosophy.

Since we are using dummies to estimate the fixed effects, in the literature the model is also known as the least squares dummy variable (LSDV) model. So, the terms fixed effects and least squares dummy variable (LSDV) can be used interchangeably.

The model estimation is performed by the least squares dummy variable (LSDV) method, namely using the method of least squares (OLS) to estimate the parameters, setting that the constant is specific to each individual being defined a *dummy* variable for each firm. The least squares dummy variable (LSDV) method, in practice, eliminates all effects that vary over the time and requires a large loss of degrees of freedom. After all, the resulting estimators are BLUE (*Best Linear Unbiased Estimator*), that is, they are the best estimators in the class of not biased linear estimators because they have the minimum variance, since the disturbances (random terms) follow the classical hypothesis and, with $N \to \infty$ and $T \to \infty$, consistents.

The estimators resulting from the least squares dummy variable (LSDV) method are known as "intra-group" (or "within groups"), as that, they concern a difference between groups/firms. The major disadvantage of this model is the case in which the database is composed of many cross-section units, which requires a lot of *dummy* variables and it leads to a significant reduction of degrees of freedom.

In order to ascertain whether the type of firm affect the autonomous/constant part of the model, we test whether the pooled regression model is appropriate (null hypothesis) against the alternative hypothesis of fixed effects model. In other words, we test the homogeneity in the constant of the model against its heterogeneity, by using the F [51] test. Therefore, the hypotheses to test are:

$$H_0 : \beta_{0i} = \beta_{01} = \beta_{02} = ... = \beta_{0N}, \quad \forall_i = 1,...,N$$
$$H_A : \beta_{0i} \neq \beta_{0j} \neq \beta_{01} \neq \beta_{02} \neq ... \neq \beta_{0N}; \quad \forall_i = 1,...,N; \quad \forall_j = 1,...,N; \quad i \neq j$$

The decision criterion is given by the understanding between the *F* statistic and *F* critical. If the first (*F* statistic) is greater than the second (*F* critical), we reject H_0.

C) Random effects model

In the random effects model, individual differences are captured by the disturbance term, rather than being incorporated into the independent term.

If the dummy variables do in fact represent a lack of knowledge about the (true) model, why not express this ignorance through the disturbance term μ_{it}? This is precisely the approach suggested by the proponents of the socalled random effects model (REM) or error components model (ECM).

The mathematical specification is:

$$\text{[A.10]} \quad Y_{it} = \beta_{0i} + \beta_1 X_{1it} + \beta_2 X_{2it} + \beta_3 X_{3it} + \beta_4 X_{4it} + \beta_5 X_{5it} + ... + \beta_n X_{nit} + \varpi_{it}$$

Instead of treating β_{0i} as fixed, we assume that it is a random variable with a mean value of β_0 (no subscript i here).

[51] In appendix 9 we explain *F* test.

Equivalently and more synthetic:

$$[A.11]\ \ Y_{it} = \beta_{0i} + \sum_{k=1}^{n} \beta_k X_{kit} + \varpi_{it}, \quad with \quad \varpi_{it} = v_i + \mu_{it}$$

Note that, starting from the fixed effects model, $Y_{it} = \beta_{0i} + \sum_{k=1}^{n} \beta_k X_{kit} + \mu_{it}$, and assuming that $\beta_{0i} = \beta_0 + v_i$, so:

$$[A.12]\ \ Y_{it} = \beta_{0i} + \sum_{k=1}^{n} \beta_k X_{kit} + v_i + \mu_{it} \Leftrightarrow Y_{it} = \beta_{0i} + \sum_{k=1}^{n} \beta_k X_{kit} + \varpi_{it}, \quad with \quad \varpi_{it} = v_i + \mu_{it}$$

The composite error term, $\varpi_{it} = v_i + \mu_{it}$, consists of two components, v_i, which is the cross-section, or individual-specific, error component, and μ_{it}, which is combined time series and cross-section error component. The term error components model derives its name because the composite error term ϖ_{it} consists of two (or more) error components.

Random effects models (REM), such as fixed effects models (FEM), assume a certain degree of heterogeneity, however, in the random effects models the effects of individual characteristics are captured by the error term. That is, in the model with fixed effects, β_{0i} is observable. By assuming that, $\beta_{0i} = \beta_0 + v_i$, being v_i a random variable (error component common to each individual), the specific characteristics of individuals are no longer observable. Therefore, it is said that in models with random effects, heterogeneity is not observable, is random.

The challenge facing a researcher is: which model is better, fixed effects models (FEM) or random effects models (REM)? The answer to this question hinges around the assumption one makes about the likely correlation between the individual, or cross-section specific, error component ε_i and the X regressors.

Inside of the various specifications of panel data models, two stand out: the fixed effects and random effects. According to Marques (2000), the justification for the choice between fixed-effects models and random effects should answer two fundamental questions: (1) the objectives of the study in question and (2) the context of the data, how were collected and the environment where they were generated.

The fixed effects models are more appropriate for the cases in which samples are removed from a complete population or when trying to predict individual behavior. However, the study may be based on a sample that was selected randomly and therefore does not represent the entire population under consideration, so, in this case, the use of random effects models will be the appropriate choice.

The model estimated by ordinary least squares (OLS) with random effects, although there is still centric, consistent and asymptotically normal, it is not efficient. The same can be said in relation to least squares dummy variables (LSDV): it is centric, consistent, but it is not efficient and, therefore, it becomes necessary to use the generalized least squares (GLS) estimator. This estimator results from a weighted average between the least squares dummy variable (LSDV) estimator or intra-group (within) estimator and inter-group (between) which is nothing more that the application of the ordinary least squares (OLS) to the model expresses in terms of average time for each individual. The generalized least squares (GLS) method circumvents the problem of the errors autocorrelation (within-unit autocorrelation). The autocorrelation of the errors makes the ordinary least squares (OLS) estimators inefficient and therefore not BLUE (Best Linear Unbiased Estimators).

To test if random effects model is appropriate, we perform *Breusch-Pagan* test[52] based in Langrange multiplicator.

[52] The statistic test is defined by:

This test, called LM-Breusch and Pagan, based on the fact that error term variance, σ_v^2, takes or not the value zero. The test hypotheses are:

$H_0 : \sigma_v^2 = 0$ (*pooled* OLS)

$H_A : \sigma_v^2 \neq 0$ (random effects, GLS)

If the LM value is greater than χ_1^2, H_0 is rejected, concluding that the unobservable individual effects are significant. Under the null hypothesis[53], the fixed effects model is a more appropriate model than random effects model.

Finally, if there is a rejection of the above hypothese H_0, it is important to choose between models with fixed effects and random effects. To this end and according to Wooldridge (2003), we use the Hausman test (H). This test is based on the idea that faced with the possibility that there is no correlation between the error term and the explanatory variables, the ordinary least squares (OLS) estimators obtained by implementing the least squares dummy variable (LSDV) method are consistent but not efficient and the generalized least squares estimators are consistent and efficient. However, the generalized least squares (GLS) in the alternative hypothesis is not consistent. Thus, the null hypothesis, in which the individual effects are uncorrelated with the explanatory variables, is tested against the alternative hypothesis which admits the existence of a correlation.

If null hypothesis is rejected, it is concluded that the correlation between independent variables and individual effects are statistically significant, and the model with fixed effects is appropriate.

$$LM = \frac{nT}{2(T-1)} \left[\frac{\sum_{i=1}^{n} \left[\sum_{t=1}^{T} \mu_{it} \right]^2}{\sum_{i=1}^{n} \sum_{i=1}^{T} \mu_{it}^2} \right]^2$$

[53] Under the null hypothesis, LM had χ^2 distribution with a degree of freedom.

The Hausman test was developed by Hausman in 1978 and it is based on the following vector of contrasts $(\hat{\beta}_{OLS} - \hat{\beta}_{GLS})$. Knowing that,

$$[A.13] \ Var(\hat{\beta}_{OLS} - \hat{\beta}_{GLS}) = Var(\hat{\beta}_{OLS}) - Var(\hat{\beta}_{GLS}),$$

We can build a test through the statistic H, since that,

$$[A.14] \ H = (\hat{\beta}_{OLS} - \hat{\beta}_{GLS})' \, (Var(\hat{\beta}_{OLS} - \hat{\beta}_{GLS}))^{-1} \, (\hat{\beta}_{OLS} - \hat{\beta}_{GLS}) \sim X_k^2,$$

where k is the characteristic matrix $Var(\hat{\beta}_{OLS} - \hat{\beta}_{GLS})$.

Schematically, the hypotheses to be tested are:

$H_0 : Cov(\beta_{0i}, X_{kit}) = 0$ (random effects, *GLS*)

$H_A : Cov(\beta_{0i}, X_{kit}) \neq 0$ (fixed effects, *LSDV*)

The null hypothesis underlying the Hausman test is that the fixed effects model (FEM) and random effects model (REM) estimators do not differ substantially. The test statistic developed by Hausman has an asymptotic χ^2 distribution.

If the null hypothesis is rejected, the conclusion is that random effects model (REM) is not appropriate and that we may be better off using fixed effects model (FEM), in which case statistical inferences will be conditional on the ε_i in the sample.

The most appropriate method here is the method of generalized least squares (GLS). We will not discuss the mathematics of generalized least squares (GLS) in the present context because of its complexity. Since most modern statistical software packages now have routines to estimate random effects model (REM), as well as fixed effects model (FEM).

Appendix 7 – Variance inflation factors

The variance inflaction factors (VIF) shows how the variance of an estimator is inflated by the presence of multicollinearity. The variance inflaction factors (VIF) is defined as:

$$[\text{A.15}]\ VIF_j = \frac{1}{1 - R_j^2}$$

Where, R_j^2 is the multiple correlation coefficient between the variable j and another independent variable.

High values for variance inflaction factors (VIF), for example, values of variance inflaction factors (VIF) above 10 suggest the presence of multicollinearity.

	Equations	Variables						
		NI^a_{it-1}	ACC_{it-1}	ΔREC_{it-1}	ΔINV_{it-1}	ΔPAY_{it-1}	DEP_{it-1}	v_{it}
	Equation [4.1a]	*5,067*						5,067
	Equation [4.1b]	1,146						1,146
	Equation [4.2a]	4,265	1,010					4,275
	Equation [4.2c]	1,444	1,297					1,131
	Equation [4.3a]	1,179		1,427	1,259	1,277	1,104	1,137
	Equation [4.3b]			1,278	1,232		1,047	1,006
	Equation [4.3c]			1,336	1,119	1,334	1,178	
	Equation [4.3d]				1,093	1,093		
	Equation [4.3f]	1,185		1,433	1,258	1,312	1,130	1,146
	Equation [4.1a]	2,266						2,266
	Equation [4.1b]	1,312						1,312
	Equation [4.2a]	2,235	1,014					2,256
	Equation [4.2c]	1,307	1,005					1,310
	Equation [4.3a]	2,040		1,103	1,103	1,167	1,026	2,011
	Equation [4.3f]	1,283		1,105	1,102	1,172	1,025	1,263

Appendix 8 – White's general test

Heteroscedasticity poses potentially severe problems for inferences based on least squares. One can rarely be certain that the disturbances are heteroscedastic however, and unfortunately, what form the heteroscedasticity takes if they are. As such, it is useful to be able to test for homoscedasticity and, if necessary, modify our estimation procedures accordingly. Several types of tests have been suggested in the literature. We use the White test, one of the most commonly used tests.

The general test of heteroscedasticity proposed by White does not rely on the normality assumption and is easy to implement. As an illustration of the basic idea, consider the following three-variable regression model (the generalization to the k-variable model is straightforward):

$$Y_i = \beta_1 + \beta_2 X_{2i} + \beta_3 X_{3i} + \mu_i \qquad \text{[A.16]}$$

Tests for heteroscedasticity are based on the following strategy. Ordinary least squares is a consistent estimator of β even in the presence of heteroscedasticity. As such, the ordinary least squares residuals will mimic, albeit imperfectly because of sampling variability, the heteroscedasticity of the true disturbances. Therefore, tests designed to detect heteroscedasticity will, in general, be applied to the ordinary least squares residuals.

The White test proceeds as follows:

Step 1. Given the data, we estimate the equation [A5] and obtain the residuals, $\hat{\mu}_i$.

Step 2. We then run the following (*auxiliary*) regression:

$$\hat{\mu}_i^2 = \alpha_1 + \alpha_2 X_{2i} + \alpha_3 X_{3i} + \alpha_4 X_{2i}^2 + \alpha_5 X_{3i}^2 + \alpha_6 X_{2i} X_{3i} + v_i \qquad \text{[A.17]}$$

That is, the squared residuals from the original regression are regressed on the original X variables or regressors, their squared values, and the cross product(s) of the regressors.

Higher powers of regressors can also be introduced. Note that there is a constant term in this equation even though the original regression may or may not contain it. Obtain the R^2 from this (auxiliary) regression.

> **Step 3**. Under the null hypothesis that there is no heteroscedasticity, it can be shown that sample size (n) times the R^2 obtained from the auxiliary regression asymptotically follows the chi-square distribution with df (degrees of freedom) equal to the number of regressors (excluding the constant term) in the auxiliary regression. That is,

$$[\text{A.18}] \qquad n \bullet R^2 \underset{asy}{\sim} \chi^2_{df}$$

where df is as defined previously.

> **Step 4**. If the chi-square value obtained in [A.18] exceeds the critical chi-square value at the chosen level of significance, the conclusion is that there is heteroscedasticity. If it does not exceed the critical chi-square value, there is no heteroscedasticity, which is to say that in the auxiliary regression, [A.17], $\alpha_2 = \alpha_3 = \alpha_4 = \alpha_5 = \alpha_6 = 0$.

To formulate most of the available tests, it is necessary to specify, at least in rough terms, the nature of the heteroscedasticity. It would be desirable to be able to test a general hypothesis of the form:

$$H_0 : \sigma_i^2 = \sigma^2 \qquad \text{for all } i,$$

$$H_1 : Not\ H_0 .$$

Appendix 9 – *F* test

If we are interested in differences across groups, then we can test the hypothesis that the constant terms are all equal with an F test, so, in order to test the significance of the group effects we use the F test. Under the null hypothesis of equality, that means, the hypothesis that α_i equals zero, the efficient estimator is pooled least squares. Symbolically, the null hypothesis to be tested is:

$$H_0 : \alpha_1 = \alpha_2 = ...\alpha_n \qquad i = 1, 2, ...n$$
$$H_a : \exists \alpha_i \neq \alpha_j \left(i \neq j \right) \qquad t = 1, 2, ...T$$

The F ratio used for this test is:

$$\text{[A.19]} \qquad F = \frac{(R^2{}_{LSDV} - R^2{}_{Pooled}) / (n-1)}{(1 - R^2{}_{LSDV}) / (nT - n - K)} \sim F(n-1, \quad nT - n - K)$$

Where $LSDV$ indicates the dummy variable model, that means, the fixed effects model and $Pooled$ indicates the pooled or restricted model with only a single overall constant term. $R^2{}_{lsdv}$ and $R^2{}_{pooled}$ are respectively the coefficient of determination $(R^2 = \frac{SS_{tot}}{SS_{reg}} \; or \; R^2 = 1 - \frac{SS_{err}}{SS_{tot}})$ resulting from the estimation of fixed effects model and pooled model, respectively; n is the number of firms; nT is the number of observations; K is the number of explanatory variable contained in the model; SS_{reg} is the regression sum of squares, also called the explained sum of squares; SS_{tot} is the total sum of squares (proportional to the sample variance) and SS_{err} is the residual sum of squares.

If the panel are unbalanced, adjustments to the total counts are made. By using the number of observations in the regression instead of nT to account for the total number of observations, proper F test is computed.

If we do not reject the null hypothesis that α_i equals zero, we do not need to analyse the fixed and random models, and we will analyse the pooled ordinary least squares (OLS) results. On the other hand, if we reject the null hypothesis that α_i equals zero, we will have differences among the firms, and we will analyse the fixed and random effects model estimators.

Appendix 10 – Portfolios of firms

Table A.1 – Portfolios of industries: persistence and predictability coefficients

Panel A: $NI_{it}^{a} = \omega_{10} + \omega_{11} NI_{it-1}^{a} + \omega_{12} ACC_{it-1} + \omega_{13} v_{it} + \varepsilon_{1it}$		
Industry	$\omega_{11}\ NI_{it-1}^{a}$	$\omega_{12}\ ACC_{it-1}$
High Earnings Quality (high persistence of abnormal earnings and low predictability of accruals)		
Food and Kindred Products	**+ 0,82**** (15,1)	**- 0,16**** (-3,16)
Pharmaceuticals	**+ 0,91**** (19,72)	**- 0,20**** (-2,79)
Manufacturers	**+ 0,67**** (20,97)	**- 0,19**** (-9,87)
Utilities	**+ 0,67**** (19,53)	**- 0,17**** (-5,22)
Industrial Transportation	**+ 0,73**** (7,41)	**- 0,07**** (-2,81)
Services	**+ 0,77**** (25,00)	**- 0,21**** (-8,79)
Medium Earnings Quality (high persistence of abnormal earnings and high predictability of accruals		
Mean	**+ 0,61**** (13,70)	**- 0,22**** (-5,49)
Medium Earnings Quality (low persistence of abnormal earnings and low predictability of accruals		
Chemicals	**+ 0,57**** (10,02)	**- 0,19**** (-2,89)
Real Estate Investment and Services	**+ 0,37**** (5,51)	**- 0,06**** (-2,49)
Low Earnings Quality (low persistence of abnormal earnings and high predictability of accruals		
Mining+Construction	**+ 0,54**** (9,98)	**- 0,26**** (-7,41)
Computers, Electronic, Software and Technology	**+ 0,59**** (16,50)	**- 0,36**** (-10,88)
Retail	**+ 0,50**** (13,89)	**- 0,41**** (-9,85)

Panel A: $NI^a_{it} = \omega_{10} + \omega_{11} NI^a_{it-1} + \omega_{12} ACC_{it-1} + \omega_{13} v_{it} + \varepsilon_{1it}$		
Industry	$\omega_{11}\ NI^a_{it-1}$	$\omega_{12}\ ACC_{it-1}$
Unclassified	**+ 0,21**** (0,75)	**- 0,31**** (-1,74)

Panel B: $NI^a_{it} = \omega_{10} + \omega_{11} NI^a_{it-1} + \omega_{12} CFO_{it-1} + \omega_{13} v_{it} + \varepsilon_{1it}$		
Industry	$\omega_{11}\ NI^a_{it-1}$	$\omega_{12}\ CFO_{it-1}$
High Earnings Quality (high persistence of abnormal earnings and high predictability of cash flows)		
Services	**+ 0,54**** (13,40)	**+ 0,22**** (9,25)
Medium Earnings Quality (high persistence of abnormal earnings and low predictability of cash flows)		
Chemicals	**+ 0,39**** (4,81)	**+ 0,17**** (2,71)
Food and Kindred Products	**+ 0,67**** (8,15)	**+ 0,15**** (3,11)
Pharmaceuticals	**+ 0,72**** (8,28)	**+ 0,18**** (2,48)
Manufacturers	**+ 0,48**** (12,20)	**+ 0,19**** (9,70)
Utilities	**+ 0,51**** (11,16)	**+ 0,16**** (5,03)
Industrial Transportation	**+ 0,64**** (6,07)	**+ 0,08**** (2,09)
Mean	**+ 0,39**** (6,65)	**+ 0,20**** (5,21)
Medium Earnings Quality (low persistence of abnormal earnings and high predictability of cash flows)		
Computer, Electronic, Software and Technology	**+ 0,27**** (5,50)	**+ 0,33**** (9,74)
Retail	**+ 0,09**** (2,82)	**+ 0,39**** (9,59)
Real Estate Investment and Services	**+ 0,32**** (4,39)	**+ 0,01** (0,34)
Low Earnings Quality (low persistence of abnormal earnings and low predictability of cash flows)		
Mining+Construction	**+ 0,31**** (4,41)	**+ 0,19**** (6,84)

Panel A: $NI_{it}^{a} = \omega_{10} + \omega_{11} NI_{it-1}^{a} + \omega_{12} ACC_{it-1} + \omega_{13} v_{it} + \varepsilon_{1it}$		
Industry	$\omega_{11}\ NI_{it-1}^{a}$	$\omega_{12}\ ACC_{it-1}$
Unclassified	**- 0,15** (- 0,40)	**+ 0,30** (1,66)

Table A.2 – Portfolios of industries: informativeness coefficients

Panel A: $\underbrace{(MVE_{it} - BVE_{it})}_{Dif_{MBV}} = \beta_0 + \beta_1 NI_{it}^{a} + \beta_2 ACC_{it} + \beta_3 v_{it} + \mu_{it}$		
Industry	$\beta_1\ NI_{it}^{a}$	$\beta_2\ ACC_{it}$
High Earnings Quality (high β_1 and low β_2)		
Manufacturers	**+ 4,80**** (22,11)	**- 1,99**** (-8,55)
Industrial Transportation	**+ 2,98**** (7,64)	**- 1,42**** (-3,65)
Medium Earnings Quality (high β_1 and high β_2)		
Food and Kindred Products	**+ 5,83**** (8,48)	**- 3,88**** (-4,99)
Utilities	**+ 3,95**** (12,02)	**- 4,08**** (-9,28)
Computer, Electronic, Software and Technology	**+ 4,97**** (12,95)	**- 3,85**** (-7,46)
Retail	**+ 4,68**** (16,03)	**- 3,52**** (-9,37)
Mining+Construction	**+ 2,01**** (7,70)	**- 2,45**** (-7,78)
Mean	**+ 2,75**** (8,55)	**- 2,07**** (-5,01)
Medium Earnings Quality (low β_1 and low β_2)		
Services	**+ 2,50**** (9,92)	**- 2,07**** (-6,67)
Chemicals	**+ 2,66**** (7,20)	**- 1,33**** (-2,78)

Panel A: $\underbrace{\left(MVE_{it} - BVE_{it}\right)}_{Dif_{MBV}} = \beta_0 + \beta_1 NI_{it}^a + \beta_2 ACC_{it} + \beta_3 v_{it} + \mu_{it}$

Industry	$\beta_1 \ NI_{it}^a$	$\beta_2 \ ACC_{it}$
Low Earnings Quality (low β_1 and high β_2)		
Pharmaceuticals	**- 1,05** (-0,96)	**- 1,04** (-0,69)
Real Estate Investment and Services	**- 0,15** (-0,47)	**+ 0,33** (0,92)
Unclassified	**- 0,16** (-0,08)	**+ 0,46** (0,21)

Panel B: $\underbrace{\left(MVE_{it} - BVE_{it}\right)}_{Dif_{MBV}} = \beta_0 + \beta_1 NI_{it}^a + \beta_2 CFO_{it} + \beta_3 v_{it} + \mu_{it}$

Industry	$\beta_1 \ NI_{it}^a$	$\beta_2 \ CFO_{it}$
High Earnings Quality (high β_1 and low β_2)		
Food and Kindred Products	**+ 2,56**** (2,82)	**+ 3,02**** (3,94)
Manufacturers	**+ 2,91**** (11,69)	**+ 1,91**** (8,25)
Computers, Electronic, Software and Technology	**+ 1,97**** (4,69)	**+ 2,46**** (4,72)
Industrial Transportation	**+ 1,71**** (4,49)	**+ 1,47**** (3,97)
Retail	**+ 1,29**** (3,68)	**+ 3,49**** (9,57)
Medium Earnings Quality (high β_1 and high β_2)		
Chemicals	**+ 1,57**** (3,69)	**+ 0,95**** (2,09)
Mean	**+ 1,06**** (2,98)	**+ 1,46**** (4,07)
Medium Earnings Quality (low β_1 and low β_2)		
Mining+Construction	**+ 0,01** (0,05)	**+ 1,84**** (6,21)
Utilities	**+ 0,71**** (1,98)	**+ 2,71**** (6,45)

Panel B: $\underbrace{(MVE_{it} - BVE_{it})}_{Dif_{MBV}} = \beta_0 + \beta_1 NI^a_{it} + \beta_2 CFO_{it} + \beta_3 v_{it} + \mu_{it}$		
Industry	$\beta_1\ NI^a_{it}$	$\beta_2\ CFO_{it}$
Services	**+ 0,63**** (2,53)	**+ 1,81**** (5,98)
Low Earnings Quality (low β_1 and high β_2)		
Pharmaceuticals	**- 1,09** (-1,19)	**- 1,28** (-0,89)
Real Estate Investments and Services	**+ 0,16** (0,65)	**- 0,39** (-1,16)
Unclassified	**+ 0,27** (0,65)	**- 0,52** (-0,27)

Table A.3 – Portfolios of industries: adjusted R^2

Panel A: $\underbrace{(MVE_{it} - BVE_{it})}_{Dif_{MBV}} = \beta_0 + \beta_1 NI^a_{it} + \beta_2 ACC_{it} + \beta_3 v_{it} + \mu_{it}$	
Industry	$Adjusted\ R^2$
High Earnings Quality (high $Adjusted\ R^2$)	
Food and Kindred Products	34,72%
Manufacturers	21,75%
Industrial Transportation	26,29%
Retail	29,64%
Unclassified	34,38%
Mean of $Adjusted\ R^2$	**17,29%**
Low Earnings Quality (low $Adjusted\ R^2$)	
Mining+Construction	8,58%

Panel A: $\underbrace{(MVE_{it} - BVE_{it})}_{Dif_{MBV}} = \beta_0 + \beta_1 NI_{it}^a + \beta_2 ACC_{it} + \beta_3 v_{it} + \mu_{it}$	
Industry	$Adjusted \quad R^2$
Chemicals	11,91%
Pharmaceuticals	4,76%
Utilities	14,13%
Computers, Electronic,Software and Technology	15,60%
Real Estate Investment and Services	0,12%
Services	5,65%

Panel B: $\underbrace{(MVE_{it} - BVE_{it})}_{Dif_{MBV}} = \beta_0 + \beta_1 NI_{it}^a + \beta_2 CFO_{it} + \beta_3 v_{it} + \mu_{it}$	
Industry	$Adjusted \quad R^2$
High Earnings Quality (high $Adjusted \quad R^2$)	
Food and Kindred Products	31,88%
Manufacturers	21,60%
Industrial Transportation	27,05%
Retail	29,96%
Unclassified	33,70%
Mean of $Adjusted \quad R^2$	**16,44%**
Low Earnings Quality (low $Adjusted \quad R^2$)	
Mining+Construction	6,78%
Chemicals	11,27%

Panel B: $\underbrace{\left(MVE_{it} - BVE_{it}\right)}_{Dif_{MBV}} = \beta_0 + \beta_1 NI_{it}^{a} + \beta_2 CFO_{it} + \beta_3 v_{it} + \mu_{it}$	
Industry	*Adjusted* R^2
Pharmaceuticals	5,02%
Utilities	10,82%
Computers, Electronic,Software and Technology	13,73%
Real Estate Investment and Services	0,18%
Services	5,32%