ERASMUS UNIVERSITY ROTTERDAM
ERASMUS SCHOOL OF ECONOMICS
MASTER ACCOUNTING, AUDITING & CONTROL

Segment Reporting

The economic benefits of the adoption of IFRS 8

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Preface

This thesis is the final objective in the Master Accounting, Auditing and Control at the Erasmus University of Rotterdam 2011-2012.

"No one is useless in this world who lightens the burdens of another."— Charles Dickens

I would especially like to thank Rob van der Wal for his advice and comments, his support changed my life.

In addition my loving partner Inge Damen for her support and compassion, and my family who always believed in me.

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Martijn Hartog

Abstract

This study functions as a final thesis for the Master of Science accounting, auditing & control at the Erasmus University Rotterdam. I investigate the effect on the cost of equity capital (COE) through a change in disclosure by adopting IFRS 8. IFRS 8 is not entirely new as it supersedes IAS 14(R). It is a revision on the topic of segment reporting. The IASB announced that the adoption of IFRS 8 should lead to a higher quality of disclosure and more uniformity. As agency theory suggests, this will reduce information asymmetry and lower investor's risk. Therefore, a lower return on equity can be accepted by the investor, which can be measured in the COE. I also investigate if firms listed in countries with a relative low debt-ratio have a more favourable COE than others.

I provide background to the adoption of IFRS and IFRS 8, how it is connected to information risk and the cost of capital. I review prior studies on these topics and how they provide evidence for the relation between the three topics and find no preliminary evidence that IFRS 8 would significantly increase disclosure values. My findings support the outcomes of prior studies, by using the modified PEG-ratio (Pennman, 1996) for the COE on a sample of EU listed firms, in the period 2008-2009 that generated 1551 observations.

I find a weak negative relation, that the cost of equity has decreased by 3.2 basis points after introduction of IFRS 8. In addition, I find strong evidence that on average companies with a higher COE are residing in lower debt-to-GDP ratio countries, and that this ratio is more of influence on the COE after adoption of IFRS 8. This paper contributes to the post implementation review of IFRS 8 (IASB, (2013)), and shows no evidence that the introduction of IFRS 8 significantly improved disclosure quality.

In addition this thesis also found no significant relation that firms operating in countries with a low debt ratio are to benefit more from a lower COE.

Keywords: International Financial Reporting Standard (IFRS), IFRS 8, Segment reporting, cost of capital, cost of equity capital, information asymmetry.

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Chapter 1: Introduction

§1.1 Introduction of IFRS

On March 12, 2002 The European Parliament passed a resolution that requires all firms listed on stock exchanges in the European Union (EU) to apply International Financial Reporting Standards (IFRS) by 2005. This means for many firms a major shift in accounting and reporting, the biggest alteration ever before. Although the effect for companies already using U.S. GAAP, which is closer to IFRS than most European domestic GAAP, could be weaker (e.g. Barth et al. 2006)

Each topic is researched beforehand to advice regulators and standard setters in creating an opinion on whether or not to accept such a resolution. Research back then already showed promise that the effect of such a resolution would benefit investors by attaining a higher level of disclosure (e.g., Ashbaugh and Pincus, 2001), increase in comparability, reducing information asymmetry and therefore could reduce the cost of capital. This is seen by many as one of the great benefits of adopting IFRS. Information asymmetry is further explained in the agency theory, see chapter 2.

The adoption effect of IFRS was a significant change in accounting standards; I want to investigate if this was also the case for the introduction of IFRS 8. IFRS 8 has become effective for publicly traded companies in the EU for their annual statements beginning January 2009. This topic is not new as IFRS 8 supersedes IAS 14 reporting financial information by segment that was effective in 1983. After a revision in 1995, IAS 14 Segment reporting became effective for annual period 1997. With this standard, the goal is to make financial information available by line of business and geographical area. This has to be included in the consolidated statements.

IFRS 8: Operating segments, is a disclosure standard that deconsolidates the group financial statements of profit and loss. When consolidating users of the annual report tend to lose information. In order to make judgements on how the company is going to perform over time, details will be missed that could be relevant in decision making. This standard adheres to the principles depicted in IFRS, where substance supersedes the legal form. In other words that

the economic substance suggests different accounting treatment than the legal structure of the company, see §2.1.3 for more information (page 9).

This thesis examines the economic consequences of mandatory IFRS 8 adoption and the effect on the cost of equity capital (COE). The International Accounting Standards Board (IASB) overtime has introduced different IAS and IFRS that harmonize with Statement of Financial Accounting Standards (SFAS). SFAS regulate companies listed at stock exchanges in the United States. SFAS is drafted to enhance transparency and accuracy in financial statements. The IFRS 8 draft has many similarities with SFAS 131. The harmonization is a large undertaking as SFAS is primarily rule based, with precise guidelines, while IFRS is founded on principles. An example is that some accounting methods are allowed under SFAS and not under IFRS, such as the LIFO (last in, first out) inventory accounting method. I want to investigate if the introduction of IFRS 8, had the desired impact of reduced information asymmetry that would ultimately be priced in the COE and merit investors and companies. With a positive outcome it would then endow the IASB for implementing IFRS 8 with content of SFAS.

The thesis will give insight in the different literature available regarding the adoption of IFRS and the effect on the COE capital and recent studies on IFRS 8. The current paradigm is that increased disclosure, that originally is intended by the IASB, also is priced and leads to a lower cost of capital, which can be seen as a positive effect for many companies. This exercise is rarely repeated for new or revised accounting standards, this research will add value to the notion that IFRS 8 also has an economic impact on society.

The cost of capital is the sum of the cost of the company's liabilities and equity. For liabilities, this is often indicated as an interest rate, and more easily attainable as these rates are determined by loan providers. However, for equity capital this is much harder to assess, as it is seen as the return on share value (dividend). For both applies that a lower rate, will provide the company more opportunity to invest in profitable operations.

Zeff (1978, p.59) described what he thought was relevant for economic consequences: "*the impact of accounting reports on the decision making behaviour of business, government, unions, investors and creditors*". It is argued that the resulting behaviour of these individuals and groups could be detrimental to the interests of other parties. And, the argument goes;

accounting standard setters must take into consideration these allegedly detrimental consequences when deciding on accounting questions. With the introduction of IFRS 8, I expect it to have an impact on behaviour, what also would be partly support by influence on the COE.

IFRS 8 supersedes IAS 14R and IFRS 8 harmonizes with SFAS131 "Disclosure about Segments of an Enterprise and Related Information". Still there are some notable differences between the two. Research on IAS 14R and SFAS 131 does not automatically provide reliable answers to the adoption of IFRS 8.

Ever since the mandatory introduction of IFRS in 2005 research studies have showed, that increased disclosure would decrease the information risk and would more favourably price the COE. For instance, Hail & Leuz (2007) research showed that the mandatory introduction of IFRS would benefit the COE in the EU, however their findings were weak due to the short sample period. They investigate capital market effects from mandatory IFRS reporting in 18 EU countries. This by analysing the COE, by using the illiquidity metric, bid-ask spreads and proportion of zero-return days.

The answer to this question would help standard setters support the premise that IFRS 8 did lead to less information risk that can be tied to increased disclosure, which is the ambition of the IASB.

§1.2 Research question

It is interesting to me to find out if the introduction of IFRS 8 had the desired results, to what the IASB was expecting (see §2.1). Did it lead to increased disclosure and reduce information asymmetry, what would be visible in a lower COE for companies? I try to validate if policy makers are still on the right track and in line with the research performed on the COE around the period of introduction of IFRS.. Did it lead to increased disclosure and reduce information asymmetry, what would be visible in the COE for companies?

I primarily want to answer the question to: *What are the effects of IFRS 8 adoption on the COE capital in the EU?* It is interesting to research this, for the implementation of IFRS 8

To create a better understanding of the research question sub-questions are formulated, which will be answered throughout the thesis. Answers to the following questions will be given:

1. What is IFRS and IFRS 8?
2. What is the difference between IAS 14 and IFRS 8 and also SFAF131 and IFRS 8?
3. What has prior literature found on the adoption of IFRS 8?
4. What is the COE capital and how can it be calculated?
5. How did the COE perform after mandatory introduction of IFRS8?

The outcome of this thesis will show evidence of reduced information risk and will validate if the ambitions of the IASB with IFRS have (partly) materialised.

§1.3 Relevance

From a financial accounting perspective, one of the most important policy issues was the mandatory implementation of IFRS for firm listed companies. As it is applicable to all EU-member states, it is interesting to regulators and policy makers to see the effect on EU-scale. Around the period of 1997-2007, research was performed on the effects of IFRS on a company's costs of capital. The majority being ex post facto, proving consensus that increased disclosure would reduce the costs of capital (see § 3.4). Prior to the mandatory introduction of IFRS this paradigm was not widely accepted (see § 3.2). This idea will be tested in my research on the update of a standard, IAS14R to IFRS 8

The study of Nichols, Street and Tarca (2013) present results from multiple IFRS 8 studies, and found significant less information presented for each segment. Although there are less companies reporting only one segment, the large majority is still reporting the same amount of segments in the year of mandatory adoption. They are also advocating more study and different methods than what was used at the time.

The topic of decision usefulness for investors is relatively unexplored. But the general idea is that non-IFRS measures and country-specific information is useful to investors. Some companies adopt them more than others do. The expectation still is that more disclosure would lead to less information risk and therefore lower the cost of capital.

§1.4 Structure

A small introduction has been shared in the previous paragraphs as a build up to the problem that will be outlined in this chapter, together with the research § and its relation to economic consequences.

Chapter 2 is dedicated to the explanation of IFRS 8 and cost of capital. I address the possible options in calculating the cost of capital. It will show that there are multiple tools for calculating the cost of capital with each its benefits and disadvantages. It is a theoretical part that will be the foundation of this study.

Chapter 3 will entail a literary review off multiple studies on the impact of IFRS adoption. It will show a transition to a uniform idea on the economic consequences of mandatory IFRS adoption and if IFRS 8 adheres to that same principle. Chapter 4 is the empirical section, explaining the research methodology. Chapter 5 will show the results and analysis, followed by the conclusion in chapter 6.

Chapter 2: Literary review

This section presents a review of empirical research on the economic consequences of IFRS and the cost of capital. Based on the agency theory the prediction is that when a firm increases its level of disclosure, it should reduce the information asymmetry and reduce the firm's cost of capital, due to the expected lower risk on opportunistic behaviour of management. The notion is that a company's willingness to more quality and quantity of its disclosures should lower the attitude towards risk and desired goals of shareholders. It may be hard or expensive for the shareholder (principal) to check the actions of the agent, to increase trust. This is still a highly relevant theory in finance to understand the organisational design of a company (Boatright et al. 2010).

Information asymmetry is at the core of agency theory and cannot be observed directly. Commitment to more disclosure has both "news" and "information asymmetry" effects, which needs to be separated. "News" being the conveyance of management to more and/or "better" quality of information. If whether at all necessary, could be a comment of management to accounting standards that they may not find the most suitable way of valuing their assets. This "news" could lead to less information asymmetry and more uniformity, regardless of management opinion.

There is also a self-selection bias, as there are more factors that influence the amount of information asymmetry perceived. An example could be that, creators of financial statement will boost information on topics they are proud of. Which makes it impossible to financial users to create causality between increased disclosure quality and information asymmetry. In short, does the information have added value in context of agency theory. For example, Barth et al. (2008) find that application of International Accounting Standards (IAS), which comprises a large portion of extant IFRS, is associated with higher quality of accounting amounts than application of non-U.S. domestic standard. So also improved accounting standards and transparency should lead to a reduction of information asymmetry, less risk of misinterpretation of information, and therefore lower the cost of capital.

Kvaal and Nobes (2010) investigate, whether IFRS practices of firms active in the big four stock markets of the EU (UK, France, Spain & Germany) and in Australia are operating differently. They conclude that there are significant differences in the variation of IFRS use

between 16 accounting issues across countries, and that national tradition of pre-IFRS is transitioned to IFRS practise, which they consider a disadvantage. They state that: "*The disadvantages outweigh the advantages of having options, so we encourage the IASB to continue its effort to remove options"*.

Based on this research, discretion is offered in IFRS that has led to various forms of IFRS. One explanation is based on the different reporting incentives firms have based on their country-specific characteristics. I will therefore highlight more research on these characteristics and confounding variables that may influence the COE and include them in my thesis.

Tang (1994) found evidence that mandatory adoption of international standards would lead to economic consequences. He expects that companies will adjust their behavior within the new standards to maximize profits. This result is applicable for the introduction of IFRS. Since its introduction in 2005, this effect has resulted in various economic consequences. The literature addressed in this thesis is focused on the effect on the COE, changing from local accounting standards (LAS) to international accounting standards (IAS).

§2.1 Introduction of IFRS 8

The International Financial Reporting Standards are created and maintained by the IASB, their mission statement states on how they perceive the creation of these standards:

"The goal of the IASB is to develop, in the public interest, a single set of high-quality, understandable, enforceable and globally accepted financial reporting standards based upon clearly articulated principles". (www.iasb.co.uk).

In order to communicate these standards to the world and to be used by listed companies in an EU securities market, financial reporting standards (IFRS) and accounting standards (IAS) have been drafted. IFRS has a total of 17 standards and IAS a total of 28. The EU adopted the regulation in 2002 to have those companies prepare their financial statements according IFRS from 2005 optionally and 2007 mandatory.

One of the accounting standards (IAS14 – Segment reporting) has been superseded by IFRS 8, operating segments. The core of the standard is described as: *'…disclose information to enable users of its financial statements to evaluate the nature and financial effects of the business activities in which it engages and the economic environments in which it operates.'* (IFRS 8, para 1).

The IASB had high expectations on the increased disclosure that would be achieved. There are few rules to be considered, to test if that was really the case (*EY: IFRS 8 Operating segments, implementation guidelines, 2009)*:

1. The purpose of the disclosure standard;
2. Define the chief operating decision maker (CODM), which is a person or body that allocates resources and regularly reviews the results;
3. The definition and clustering to segments;
4. Mandatory items that are to be disclosed.

With IFRS 8 a new perspective was introduced in the EU, the managerial approach on the performance of segments. This concept would bring the view of management public, and would bring a change to how segments are identified, measured and to the level of disclosure. With this in mind the following effects would be expected by the IASB (2013):

- Companies will identify segments, no longer based upon activity, size and revenue from external customers. Separate segments and other operations may need to be disclosed;
- Performance would be measured differently than previously, as it will be reconciled to the consolidated financial statements;
- Companies would no longer need to make 2 reports, one for internal use and one for the financial statements. Thus, quality should be good overall as the CODM will use the same as the user of the financial report.
- There will be an increase of information available to the public.

§2.1.1 Purpose of IFRS 8

In essence, IFRS 8 looks at the group set of financial statements and deconsolidates these into segments. In those financial statements all the assets, liabilities, income and expenses are consolidated, with the principle of substance over legal form. The result is, that there is no

insight in the asset base of each subsidiary or how well each has performed. By consolidating, one tends to lose information that can be used to make judgements on how the company is going to perform overall in the future. To remedy this issue, IFRS 8 should lead to a better understanding of the elements of that company and how they have performed compared to each other.

With the past performance information, one is now able to calculate ratios, and gain insight in the risks and rewards of each segment. With this level of disclosure, the information asymmetry should be diminished as investors are able to make better informed decisions.

§2.1.2 Chief operating decision maker

By definition, the CODM represents the individual or group of people that have control, regularly review the results and have the ultimate say over the company. As IFRS 8 is an international standard, it cannot dictate specifically which function in the company this person is. For instance, a CEO can have different roles or referred to differently per company.

This does not indicate that all operating segments will need to be disclosed separately. As large companies have hundreds of legal entities, reporting on each of them would not benefit the user of the accounts. The annual report would significantly grow in size, as each entity would share its results and notes in the account.

The concept is, that readers of the financial statements would have the ability to look at it just as the CODM. And that the users of the accounts would also get an internal view of how the group operates.

§2.1.3 Segments & disclosure items

In order to identify the segments, the focus will be on the scale of the segment. The larger the segment, the more relevant it becomes to disclose. The parameter for mandatory disclosure is that the segment's assets, revenue or profit is larger than 10% of the total revenue. This is identical to predecessor IAS 14. However, there is an overriding rule that if the total segment revenue is lower than 75% of the external revenue, additional segments need to be disclosed.

Segments can be combined if they have similar economic characteristics, provided if they operate in the same function. The nature or services of the product needs to be similar. The nature how you produce the goods, class of customer, distribution of goods and how it is regulated by government. If any are similar, it is allowed to combine. This is also identical to IAS 14, the difference here is that IAS applies a hierarchy, where the primary segment needs to disclose more than secondary segments.

The standard dictates a minimum set of information to be disclosed, it is optional to disclose more than the IFRS 8 finds necessary. Companies must remain prudent and savvy not to disclose too much, that could jeopardise their competitive advantage, or see merit in the increased disclosure and report more items to take advantage of lower cost of capital rates. For each segment the results (profitability), revenue, assets, liabilities, capital expenditure, depreciation, amortization and non-cash expenses need to be disclosed.

§2.2 Models of COE

Unfortunately studying the COE does bring its challenges as it is not measured in a uniform way. I address the many options there are, and to each equation, the outcome will be different as the premise of the calculation differs. Researchers have their preference to each or multiple models to help substantiate their findings.

Mogliani and Miller (1958) have created more insight in the cost of capital, which is the total of equity and liabilities in their Capital Asset Pricing Model (CAPM). It is used to evaluate activities of a company and the minimum return that investors expect to receive for providing capital for that particular company.

If a firm decides to invest in their existing or new activities, the expected return should be greater than the cost of capital in order it to be worthwhile. If different projects have different costs of capital, risks and different returns, a firm can make a selection as to which project is most lucrative.

An individual or company can decide to invest in liabilities or equity, for example providing a loan or shares. For each the premise and conditions are different, e.g. the costs and return differ. Reporting on these items will increase comparability and decision usefulness.

In this section, I will elaborate on the calculation methods for the COE. This will give more insight in the possible options for calculation the COE and make a suitable selection useable in the research design.

§2.2.1 Capital Asset Pricing Model (CAPM)

After Mogliani and Miller (1958), the CAPM was further developed by Sharpe (1964) and Lintner (1965). The model represents predictions on how to measure between risk and expected return. By doing so, one is able to calculate the COE and thereby also able to evaluate the performance of managed portfolios.

To determine a company's cost of capital (debt + equity) one must therefore calculate both the cost of debt and the COE. It is preferred to use the rate of return calculation method to assess the cost of capital. It is comprised of the risk free rate of interest (rf) and a premium for the firm's non-diversifiable risk (rprem) as written in an equation:

$$r = r_f + r_{prem}$$

The cost of debt is relatively simple to calculate, as it represents the effective yield on a loan. This can be modelled as the risk-free rate plus a risk component, the risk premium, which itself incorporates an amount on the expectancy of defaulting on the loan.

The COE in the CAPM is broadly defined as the risk-weighted projected return required by investors. The COE is therefore inferred by comparing the investment to other comparable investments with similar risk profiles to determine the "market" COE. Botosan (2006) describes this as “the risk-adjusted discount rate that investors apply to expected future cash flows.”

A consideration is that this model expresses the expected return of an asset in an equilibrium where demand meets supply (at the Capital Market Line), and that this model is in balance. This is only theoretically possible. Stulz (1995) questions the validity between using a local CAPM versus an international CAPM where he is making an argument to consider whether markets are fully integrated or segmented. There is also literature to be found, debating the non-diversifying risk that is calculated in this method, which is hard to observe (Hail & Leuz, 2004).

§2.2.2 Residual Income Valuation model (RIV)

There are multiple empirical models created to give insight into the reporting quality and the implied equity cost of capital. These are presented in papers by Claus and Thomas (2001), Gebhardt et al. (2001), Ohlson and Juettner-Nauroth (2005) and one of them is the Residual Income Valuation model (RIV), derived from the model of Ohlson (1995).

The notion is that a value creating company has a positive residual income, which is the net income – the equity costs. The RIV is calculated based upon value stocks, stock that appear to be undervalued, which are summed up from two factors; the current book value of equity and the present value of expected future residual income.

In the model, the clean surplus accounting principle cannot always be sustained. When a company has any off-balance sheet values, or discretionary accruals, this will not be valued and make the model less suitable (Botosan, 1997).

§2.2.3 Abnormal Earnings Growth model (AEG)

Another model which can be used to calculate the COE, in combination with other models, is the abnormal earnings growth model (AEG) of Gode and Mohanram (2003) and Easton (2004). This model is based on three or four proxies (assumptions / measurements of equity cost of capital) related to a main economic consequence variable, such as the COE. For the AEG model, the focus is on future earnings and earnings growth of the firm, best seen as to which way the current price depends on forward earnings per share (EPS) and growth.

§2.2.4 price-to-earnings ratio (P/E-ratio)

Another relative valuation model is the price-to-earnings ratio (P/E-ratio) adjusted for growth and dividend pay-out. The P/E-ratio' origin is from the dividend discount model, with the use of clean-surplus accounting. The assumption is that the return on equity is more or less the same as the cost of capital, that is characterized by projecting earnings growth (Gordon 1962). Pennman (1996) states that the *"P/E-ratio indicates future growth in earnings which is positively related to expected future return on equity and negatively related to current return*

on equity". According to Botosan (1997) *"this measure has been used in the past by academics and practitioners to estimate COE capital that does not impose such restrictions"*.

The limitation in the model is that economic growth between companies is not congruent and differ greatly between sectors, as their business model is different. The value of this model becomes more meaningful when compared with the ratios in the same sector. Leverage is also a big factor, as the height of debt can affect share prices and skew the P/E-ratio (Easton, 2004).

§2.2.5 Price-earnings growth model (PEG)

The fifth model is the Price-earnings growth model (PEG) created by Ohlson and Juettner-Nauroth (2005). This model is derived from the AEG model, but stating that $\mathrm{dps}_{t+1} = 0$ and $\gamma = 1$. By doing so they are suggesting that there is no abnormal growth beyond the forecast horizon. Easton (2004) suggests that the COE capital of a firm can therefore be inferred from the PEG model. The PEG model calculates a ratio for determining the relative trade-off between the price of a stock, the earnings generated per share (eps), and the company's expected growth. "The key element of the model is the central role of short-term forecasts of earnings valuation" (Easton 2004). The COE capital is the extract of the root of earnings per share for two years ahead minus earnings per share for one year ahead, this must be divided with the current share price at year-end.

The variables are the same as in the AEG model, although it has alternate assumptions. Lee et al. (2008) assume that earnings growth will not change beyond the (short) earnings forecast horizon and that there will be a constant growth of the earnings. This also means that eps will need to be positive and eps_{t+1} lower than eps_{t+2} otherwise it will result in a negative COE, which is not possible as it will result in a negative division. This automatically means that the firms in this assumption are considered to be stable companies, with relative low risk. However, "there is no reason to say that these assumptions could materially affect our COE capital comparisons" (Lee et al. 2008).

§2.2.6 EBO valuation model

The abbreviation stands for the Edwards-Bell (1961)-Ohlson (1995) valuation model. It is based upon the discounted residual income approach. This approach has had derivations

during the years, where a stock's value is fundamentally based upon the future value of expected dividends.

Frankel and Leeb, 1998 made an interesting quote that: *"This equation is identical to a dividend discount model, but expresses firm value in terms of accounting numbers. It therefore relies on the same theory and is subject to the same theoretical limitations as the dividend discount model. However, the model provides a framework for analysing the relation between accounting numbers and firm."*

§2.2.7 Industry ROE model

This model is based upon the discounted residual income approach. However, the equation is expressed as a share price in terms of an infinite series and specific periods must be specified. Therefore, Gebhardt et al. (2001) created a Terminal Value after forecasting the explicit period.

§2.2.8 Economic-wide growth model

Claus and Thomas (2001) notice the same problem as Gebhardt et al. (2001), that share prices are founded on an infinite future and not constrained to specific time periods, instead they assume perpetual growth rate which is mostly linked to the expected inflation rate. An assumption is that after 5 years the abnormal earnings growth rate will become stable.

By evaluating these models it becomes clear that the PEG model has the least assumptions, which makes the model more applicable and more relevant than the others. However, there is no consensus on which model is the best. Quality of reporting is only one of many factors, which could influence the cost of capital, so it is important to define the proxies closest to the factor I wish to investigate.

§2.2.9 Model selection

For this thesis I will limit the calculation to a relative valuation model, as they are simple to process, easy to understand and state the market value as it also the principle of IFRS. I am aware that these ratios may not be comparable between companies in different sectors and a high share price volatility will increase the range of the P/E ratio and will distort the companies' value.

The model created by Ohlson and Juettner-Nauroth (2005), as depicted below:

$$COE_t = \sqrt{\frac{(eps_{t+2} - eps_{t+1})}{P_t}}$$

eps_{t+2} = expected earnings per share for two year ahead

eps_{t+1} = expected earnings per share for one year ahead

P_t = share price at year-end

I use the PEG Model (Lee et al. 2008), where the future Earnings per share (eps) are deducted from the eps from the prior year and divided by the share price that year before. For the **earnings-to-price ratio** adjusted for growth and dividend pay-out there is also an association problem with measures of risk. Penman (1993) argues that the E/P ratio may be used to estimate the COE capital only in the rare situation where expected future earnings is current earnings adjusted for growth at a rate equal to the cost of capital. He points out that prior research fails to find a connection between the E/P ratio and measures of risk because: "*E/P ratios reflect cross-sectional variation in the ability of firms' current earnings to predict their future earnings more than they reflect cross-sectional variation in COE capital*".

Despite the remark of Penman, this model is widely used in similar studies, which helps comparability between these type of studies. Plus I expect the data needed to be used in the model to be more easily attainable and lack of bias. As this is of key importance in this study I will continue with the PEG-model.

§2.3 Research that lead to an increase in the cost of capital

Dargenidou, McLeay and Raonic (2006) assess the available evidence on the impact of different accounting regimes in European countries. They expect that different accounting regimes in the period leading up to regulatory changes, will lead to biased expected earnings that could influence the cost of capital. This provides preliminary evidence on the effect of the voluntary pre-adoption of international standards. They use a European sample based on the abnormal earnings growth model to test how the change from local GAAP to IAS affected the estimated cost of capital. They find that the cost of capital increased by more than 4% after voluntary adoption. *"This stems from the inability of market participants to see through differences in the conservatism bias in financial accounts, which is attributable to the*

different sets of GAAP in operation and move to IFRS". Although the effect was weaker for large firms and the costs are only short-lived. As condition they do mention that not only on the type of standards adopted but also the pre-adoption level of disclosure the firm had, is of relevance to their outcome.

§2.4 Research that lead to mixed results in the COE capital

It is only when Daske (2006) devotes a paper based on a valuation model of German firms, based on both empirical implementations of the Residual Income Valuation model (Gebhardt, Lee and Swaminathan (2001) and Easton, Taylor, Shroff and Sougiannis (2002)) and of the abnormal earnings growth model (Gode and Mohanram (2003) and Easton (2004)), different empirical evidence is gained. Accounting for 13,000 HGB, 4,500 IAS/IFRS and 3,000 US-GAAP firm-month observations in the period from 1993 to 2002, they find no evidence of a reduced cost of capital when using both the residual-income valuation model and the abnormal earnings-growth model of Ohlson and Juettner-Nauroth (2005) to estimate the implied COE.

Cuijpers and Buijink (2005) also examined the determinants and consequences of voluntary adoption of non-local accounting principles by firms listed and domiciled in the EU. They use a European sample to test the effect of changing from local-GAAP to either IFRS or US-GAAP. Based upon information asymmetry proxied by analyst following, forecast dispersion and stock return volatility the implied cost of capital is estimated using the abnormal earnings growth model. They find that the rate of adoption of non-local GAAP by non-financial firms domiciled and listed in the EU in 1999 is relatively low and conclude that the economic benefit of switching to IAS or US-GAAP is low for many firms. Typically, the benefit of adoption is highest in countries with a lower quality of financial reporting and where IAS is allowed. Also, they conclude a positive effect of adopting IFRS or US-GAAP on analyst following but fail to find support for a lower implied COE.

Daske, Hail, Leuz, and Verdi (2007) contribute to IFRS studies by focussing on whether the impact varies on the degree of compliance. They investigated capital-market benefits from the adoption of IFRS in the EU, based upon 3 proxies: existence of externalities, economy-wide cost savings and stricter sanctions for firms. They investigated 5683 EU firms in the period of

2001-2005, also the period before mandatory adoption of IFRS in the EU. Based upon 4 dependent variables/proxies:

1. Modified PER-ratio, for cost of capital, with 2 yr. share-forecasts & expected dividends (Easton, 2004);
2. Bid-Ask spread (Welker,1995);
3. Illiquidity metric (Amihud, 2002);
4. Proportion of zero daily returns (Lesmond,Ogden & Trzcinka, 1999).

The results of this empirical analysis provide a mixed picture for the capital-market effects of mandatory IFRS reporting in the EU. Evidence was found that only early adopters would have any benefit. The descriptive statistics do not indicate major structural breaks or changes in the capital-market variables, suggesting that the effects of IFRS reporting are likely to be modest.

Another stream of research is based on an event-study with a cross-sectional investigation on firms that have adopted IFRS or US-GAAP and firms that use local-GAAP. Leuz and Verrecchia (2000) and Leuz (2003) take this approach by examining bid/ask-spreads, trading volume and share price volatility as proxies for the information asymmetry component of the cost of capital. They find reduced information asymmetry when firms change from German GAAP to either IFRS or US-GAAP, but no significant difference between IFRS and US-GAAP.

Christensen, Lee & Walker (2007) examined the economic consequences of mandatory adoption (starting 2005) of IFRS in the UK. They use German firms as a control group where adoption of IFRS was a matter of choice already since 1998. They investigated the short-term price response to news on IFRS adoption and changes in long-run implied COE. Their focus was on 52 firms in the UK, which are listed at the stock exchange. They used the observed voluntary GAAP choices of German firms to predict which UK firms would be more likely to adopt IFRS given the same choice with a regression model, and developed a counter-factual proxy. Their assumption was that there is a positive relationship between a UK firms' degree of adoption to the similarity of the characteristics of German voluntary IFRS adopters. They also assume the same for the stock-price reactions to announcements relating to mandatory IFRS adoption. In order to assume a positive relationship between UK companies and the characteristics of voluntary German IFRS adopters, they applied the calculation of the Sefcik

and Thompson (1986) portfolio-weighting approach commonly used to test the effect of firm characteristics on stock market reaction to time clustered events (e.g., Comprix et al., 2003; Li, Pincus and Rego, 2004). Their second goal was to investigate the long-run implied COE. In order to calculate long-run changes in the cost of capital of UK firms after the mandatory IFRS adoption they used abnormal earnings valuation model (Ohlson and Juettner-Nauroth (2005)) and the Easton (2004) PEG model. They claim that this proxy can predict cross-sectional variations in the economic consequences of mandatory IFRS adoption in the UK. By using an event-study methodology that finds evidence on the stock-price reactions of UK firms to announcements that are related IFRS adoption. Those announcements are hence related to UK firms' willingness to adopt IFRS. This depended on firm characteristics and mandatory IFRS adoption has a different effect on the cost of capital. The result was that firms with similar characteristics to German voluntary adopters have greater benefits from international accounting harmonization and in particular from mandatory IFRS adoption. Considering that the foundation of UK-GAAP is different to HBS, where UK-GAAP is of a higher quality standard more like IAS than German-GAAP, firms where the change toward a new GAAP is highest have more positive benefits.

§2.5 Research that lead to a decrease in the cost of capital

The introduction or alteration of accounting standards is seen as an economic consequence where Armstrong et al. (2006) wrote about the controversy surrounding the adoption of IFRS in Europe. Proponents believed that IFRS adoption would benefit investors for three primary reasons. First, proponents of IFRS believed application would result in higher quality of financial reporting than application of domestic European standards does. Thus, improvements in financial reporting and disclosure resulting from application of IFRS would lower information asymmetry and information risk. Second, application of a single set of standards would result in lower costs of comparing performance of firms from different countries. Third, European capital markets would experience increased capital flows from outside of Europe and become more globally competitive, thereby increasing liquidity for European firms.

Bevers (2009) investigated Dutch listed firms and found a decrease in the COE in the period 2003 till 2006. He argues that IFRS, with mandatory adoption in 2005, is still criticized and

that by finding evidence of 106 base points reduction in the COE, IFRS did reduce information asymmetry. With this result, he expects the criticism to further diminish.
Li (2008) examines whether the mandatory adoption of IAS in the EU in 2005 reduces the COE capital. He uses a sample of 6,456 firm-year observations of 1,084 EU firms during the period of 1995 to 2006, calculating the COE from using the average estimates from four implied cost of capital models proposed by Gebhard et al. (2001), Claus and Thomas (2001), Gode and Mohanram (2003), and Easton (2004). They control for variables that include whether a firm is: cross listed in the U.S., country-specific inflation rate, firm size, return variability, financial leverage & industry and country fixed effects. They document that mandatory adopters reduced their cost of capital by 48 basis points, and that there is no effect for voluntary adopters. The conditions for these results are strong legal enforcement, enhanced disclosure and comparability.

Daske, Hail, Leuz and Verdi (2008) continued this topic and did an examination of mandatory adaption of IFRS around the world based on the effects of market liquidity, cost of capital and Tobin's *q* in 26 countries where it is mandatory to adopt IFRS. They investigated 3100 firms in the period from 2001-2005 based upon a cross-sectional variation with firm-year panel regression/data analysis. One of the results was that market liquidity increases 3 to 6% around the time of introduction, the cost of capital decreases by 26 basis points and an increase in equity valuation with Tobin's *q* to 7%. Although these are strong arguments to adopt IFRS, some countries do not meet the conditions for these results to maximize their effect. Namely, strong legal enforcement is one of the requirements for a country to have and a firm needs to have an incentive to be transparent and give more disclosure. In addition, they define that the benefits are greater when voluntary adoption is applied.

One stream of research examines proxies for the cost of capital within an event-study around the adoption of IFRS or US-GAAP. Such as, Armstrong et al. (2006) examine the European stock market reaction to key events surrounding the adoption of International Financial Reporting Standards (IFRS) in Europe. They define 16-events which are related to the adoption of IFRS and compare them to the stock market reactions of all public firms in the EU from 2002 to 2005. This is the period before IFRS became mandatory in the EU. Based on a three-day market-adjusted return (MACRe) from the Dow Jones STOXX Global 1800

Index, they find significant market reactions in events that are linked to IFRS adoption and the decrease of COE.

Research done by Botosan (1997), Botosan and Plumlee (2002), Hail (2002), Francis et al. (2004) and Hail and Leuz (2006) provide evidence that increased and higher quality of disclosure led to a lower COE capital. As the IFRS framework is for most EU-countries an improvement in disclosure quality than to EU countries' local GAAP (Levitt, 1998), the expectancy is that this effect is carried throughout the EU. Although research of Burgstahler, Hail, and Leuz (2006) showed scepticism on the effects on capital-markets as that they provide evidence that the use of accounting standards is subdue to a selection bias, other factors that also influence capital markets, and the willingness to disclose private information. The way firms use accounting standards is therefore dependent on their reporting incentives. These incentives are influenced by the industry the firm is operating in, countries' legal setting and other market operators.

This section present insight into research made on companies that attain a significant higher quality in financial disclosure, benefit the most by adopting IFRS. Also, legal setting, enforcement and the company's liquidity are key parameters to support the argument. The presumption after studying most recent research is, that there is a strong relation with increased disclosure quality and COE capital and that this is accepted throughout countries of the EU.

§2.6 Research on IFRS 8

Nichols, Street and Cereola (2012) investigated adoption of IFRS 8 on European blue chip companies. Their research finds a significant increase in the mean of reportable segments in 14 largest stock markets in Europe. This was the IASB expectation based on their analysis of research on SFAS 131. However, they find significant less information items, especially in liabilities and CAPEX. They are not the only ones finding a decrease in the number of disclosures, as this is also supported by Crawford et al. 2012; Weissenbergen and Franzen, 2015; Bugeja et al.,2015 and He et al., 2012.

A later study of Nichols, Street and Tarca (2013) was focused on the impact, advantages and disadvantages of the managerial approach imbedded in IFRS 8 and SFAS 131. They studied many papers on this topic, and came to a consolidated conclusion that:

1. The number of line items per operating segment have decreased;
2. Decreased disclosure of CAPEX, liabilities, equity method income and assets;
3. Increase in geographical segments and country-specific information;
4. Reduction of companies with a single segment;
5. No proof that non-IFRS measures are useful to investors;
6. No evidence that IFRS 8 highlights the risk relevant to managers;
7. Changing segment presentation interferes with the ability to develop time series data.

Nichols et al. 2013 clarify the weaknesses of the literature available and make suggestion for further research. Another recent study on IFRS8 (Nichols, 2012 & 2013 – Aleksanyan, 2015 – Kajüter, 2017) find evidence to a reduction on information asymmetry and the combination of increased disclosure. However, they show that the desired results from the IASB are partly achieved and even had negative effects. Nichols et al. 2013 find evidence, which makes it arguable if a reduction of information asymmetry is attained.

Based on paradigm in current research my null hypothesis is:
H0 = *IFRS 8 lead to increased disclosure and a decrease of the COE in the EU*.

The alternative hypothesis is:

H1 = *IFRS 8 did not lead to increased disclosure and a decrease of the COE in the EU*

Risk is a strong influencer of the COE. Since IFRS 8 had its introduction in a period of economical downfall, I suspect that country macro-economic circumstances will be of influence. If you were to invest in a company that is more likely to go bankrupt, the risk of default is higher and as an investor would want to be compensated according to the level of risk. The higher the risk, the higher the return. Each investor is balancing their risk/reward for each investment. I want to investigate if this is also comparable when a country is more likely to default. Greenspan, 2010 implies the monetary policies applied were not the source of the worldwide recession, but the high volume of sub-prime mortgages. This crisis lead banks to go bankrupt or most to be saved by government, creating the term “too big to fail”. The

solvability and liquidity of a country is important to reduce the negative effects of the recession. Firms in low-leveraged countries would be expected to benefit more that others.

H0: *Countries with a below average debt ratio do not have a lower COE.*

H1: *Countries with a below average debt ratio have a lower COE.*

In practise no country has defaulted. Greece came close in 2012, but was helped by other EU countries to avoid disaster. For such riskier countries I expect in general a higher COE to those that have a below average debt ratio.

§2.7 Summary

When addressing the literature chronologically, the time around the introduction of IFRS, literature was supporting the expectation that the costs of capital would decrease (Leuz, 2000). However, after the introduction of IFRS results became more mixed. Around 2006 more historical data was available, leading to positive, negative and mixed results. In literature countries, companies and methodology for many are different, making it hard to compare each finding to another.

With this information it is possible that the IASB is negatively contributing to the costs of equity when IFRS 8 was introduced. This standard would provide more freedom in the amount of disclosure items which would reduce comparability. This I find similar to early voluntary adoption IFRS, as this would reduce comparability for that year to others that not early adopt. Also Li (2007) did not find any evidence that companies would benefit as early adopter in his IFRS study. Adoption of IFRS 8 does not result in a lower COE, even if they early adopt and use more than the required disclosure items.

Segment reporting has not changed much, at least if you consider the requirements on reportable items between IAS14 and IFRS 8. The IASB has favourable expectations with the introduction of IFRS 8, due to the managerial approach. The IASB expects to realise a reduction of costs for the company to create the report and an increase in disclosure as more segments would be included in the annual statement.

The COE is the residual shareholder interest in assets after deduction of liabilities. The value of the equity can be determined by absolute- and relative valuation models. The absolute

models estimate the intrinsic value, such as the present value -, dividend discount -, residual income value - and free-cashflow to equity model. The relative models are founded on the belief that the market may be wrong on the given value of a stock. Such as the Enterprise value method (measure of a company's total value) and the absolute models founded on multiples of which the Price-earnings-growth ratio.

The concept of the Principle-agent theory is a driver to increase disclosure in annual statements. So was the case for the introduction of IFRS 8. Not much research is available on single standard introductions on the COE. Based upon research on the introduction of IFRS, information is gained that recent studies find evidence that increased disclosure does lead to a lower COE. My thesis will research, if this was also the case for the introduction of IFRS 8 and if the level of a countries' debt is of significant influence on the COE.

Chapter 3: Methodology

The literature addressed in the previous chapter is to support the main question of this study: *What is the effect of IFRS 8 adoption on the COE capital in the EU?* In recent literature, there is more consensus that increased disclosure leads to a reduction in COE (see §2.2).

This study has similarities to the working paper of Li, (2007) that examines the implications of the mandatory adoption of IFRS in 18 EU countries in the period 1995 to 2006. The outcome was a significant drop in the COE capital of 48 points. Using his methodology will make findings in this thesis comparable to his design. The introduction of IFRS can be seen as a big corporate event in disclosure requirements. I will test if this also upholds when adjusting standards as in the situation of IFRS 8 specifically.

§3.1 Research design

The implied COE will be measured over the period 2008-2009. Mandatory adoption for IFRS 8 was in effect for annual periods from the first of January 2009. Because of the developments on IFRS, stretching the sample period would devalue findings. The ex-post period of 2008 is stable as there was one introduction, IFRS 7: Financial instruments. As from January 2009, many other amendments were effectuated[1]. In 2009 the largest amendment was IFRS 8, as I consider the rest not significant to my study.

In that period, the COE capital has been subjected to many factors that also influence the COE, called positive externalities. I will need to control for them. Based on a time-period related dummy variable α_0. This independent variable α_0 is a dummy that captures the firms adoption of IFRS 8, and is coded one when adopted and zero otherwise.

I apply a set of control variables, to mitigate institutional changes and macroeconomic effects as an influencing factor. I expect inflation in general, on macroeconomic level to be the most influential factor on the cost of capital. Investors want to be sufficiently compensated for their money despite a country's monetary position. The firm-specific characteristics are denoted in

[1] IFRS 1: Amendment relating to cost of an investment on first-time adoption, IFRS 2: Amendment relating to vesting conditions and cancellations, IFRS 7: Amendments enhancing disclosures about fair value and liquidity risk, IAS 1: Comprehensive revision including requiring a statement of comprehensive income, IAS 16, 19, 20, 23, 27, 28, 29, 31, 32, 36, 38, 39, 40 & 41: Amendments resulting from May 2008 Annual improvements to IFRSs

the $\sum \alpha_j Controls_j$ section of the equation that is explained further in this paragraph. It is the sum of traditional firm-risk- and country controls as described below:

1. The book-to-market ratio. The concept is that the higher the ratio the higher the risk of negative stock price growth. Therefore, I expect a positive relation between this ratio and the COE capital. Firms with a ratio over 1 (difference between market value and book value) indicate an overvalued stock price (Li, 2008).

2. The Return on assets is an indicator on the firm performance of making money out of their assets. It is calculated by dividing the net income with the total assets, the higher the better. High profitability makes a firm less susceptible for defaulting, which would lead to less risk and a negative relation to the COE capital (Bevers, 2009). I windsorized the data asymmetrically with values over 18 to 19 and lower than -8 to -9.

3. The volatility of stock price is also an indicator for risk, the higher the volatility of the stock the riskier the investment which results in a more expensive cost of capital. The volatility is calculated as the annual standard deviation of the monthly stock returns at year-end (Lee et al., 2008). This control variable will most likely have a positive relation with the COE capital. I windsorized the data with 0.1 on values over 0.8 and under 0.11 and applied a natural logarithm.

4. The size of the company is also related to risk, the smaller the company the more risk of going concern. The indicator should therefore be negatively related to the cost of capital and positively to the volatility of the stock price. The size of a firm is based on the total assets as they differ much from one another, these have to be made more comparable. In order make the numerical difference between firms smaller a natural logarithm is used to make the data more useable (Hail & Leuz, 2006) and I windsorized the data with 0.1 if the value is over 7.7 and under 3.3.

5. The financial leverage of a firm is also used as the leverage is an indicator on how dependent a firm is on third parties. The concept is that it is positively related to the

cost of capital, as a lower leverage leads to more independency and less risk. I winsorized the data with 1 when over 1000 and under 0.11 to 0.10 and transformed the data with a natural logarithm.

6. Inflation, as this impact the nominal risk-free rate of interest that impacts the COE. Hail and Leuz (2006a) indicate that "the resulting estimates for the cost of capital reflect countries' expected inflation rates". In times of deflation the cost of capital will be relatively low, which generates an imperfect view for that period. The inflation rates for the countries in the EU are to be found in the DataStream database. A dummy variable is applied to distinct between high or low inflation. Calculated as the yearly median of that country, where high inflation is over 4% coded as one, and below 4% inflation as zero. The variable is denoted as CPI.

7. I want to control for firm-specific characteristics. The assumption is that increased disclosure benefits all firms, although I expect not equally as much over the industries. In order to mitigate firm risk. Hail and Leuz (2006) created a suitable counterpart for controlling factors when calculating the COE capital. They expect based on prior empirical research that the cost of capital to be negatively associated with firm size and to be positively associated with stock return volatility (beta) and the book-to-market ratio (e.g., Fama and French (1992, 1993)). However, I used a dummy for accounting classification of the country according the Nobes, 2008 study. A category that has strong equity and is commercially driven (coded 0), and the other group that is characterised with weaker equity, is government driven and tax-dominated (coded 1). I expect this to have the need of an industry dummy obsolete. The variable is denoted as Acct.cls.

8. A dummy for post adoption, the year 2009 is coded with 1 and 2008 with 0. I standardized this dummy by substracting the mean and divide with the standard deviation, to avoid multicollinearity,

9. Dummy for country leverage calculated on the average Debt to GDP score of that country. I coded countries with a higher than average 1 and lower with 0. The variable is indicated as (G2D).

In order to match incomplete relationship an error-term (ε) is used, also known as the residue. This is an indicator that displays when other factors are applicable if ε should not amount to zero. I will attempt to create a sample as large as possible to lower the standard error as much as possible.

By creating a difference-in-difference design it is possible to investigate the relevant change to pre- and post-adopters for the COE capital. Resulting in the following equation:

$$COE = \alpha_0 + \alpha_1 * Dummy\ for\ post\ adoption + \sum \alpha_j Controls_j + \varepsilon$$

Where:

$$\sum \alpha_j Controls_j = BMR + ROA + VOL + TA(size) + LEV + Dummy\ inflation + Dummy\ acc.class.$$

The model will be computed in MiniTab as a linear regression model. The assumption is that the error term has a normal distribution with a mean of 0, the error term is constant across cases and independent of the variables in the model, heteroscedastic.

The assumptions for the variables are that they are normal distributed, low skewed or kurtosis. To calculate the COE, I followed the footsteps of Hail & Leuz (2007), Li (2008) and calculate the COE capital by means of the modified price-earnings growth model by Penman, 1996.

$$\mathrm{COE_t} = \sqrt{\frac{(\mathrm{eps_{t+2}} - \mathrm{eps_{t+1}})}{\mathrm{P_t}}}$$

Where $\mathrm{P_t}$ stands for the firm's stock price at period t, eps for expected future earnings per share. To summarize, the requisitions are the current stock price data (Pt), analyst earnings per share forecasts for two periods ahead ($\mathrm{eps_{t+1}}$and $\mathrm{eps_{t+2}}$). That information is obtained in the

I/B/E/S database. I transformed the COE as dependant variable with a natural log + as the original data was not normal distributed.

I also want to investigate the effects of being listed in a country that is above average in debt, compared to the EU average by using a dummy variable. For this I created an interaction term between two dummy variables, resulting in the equation below:

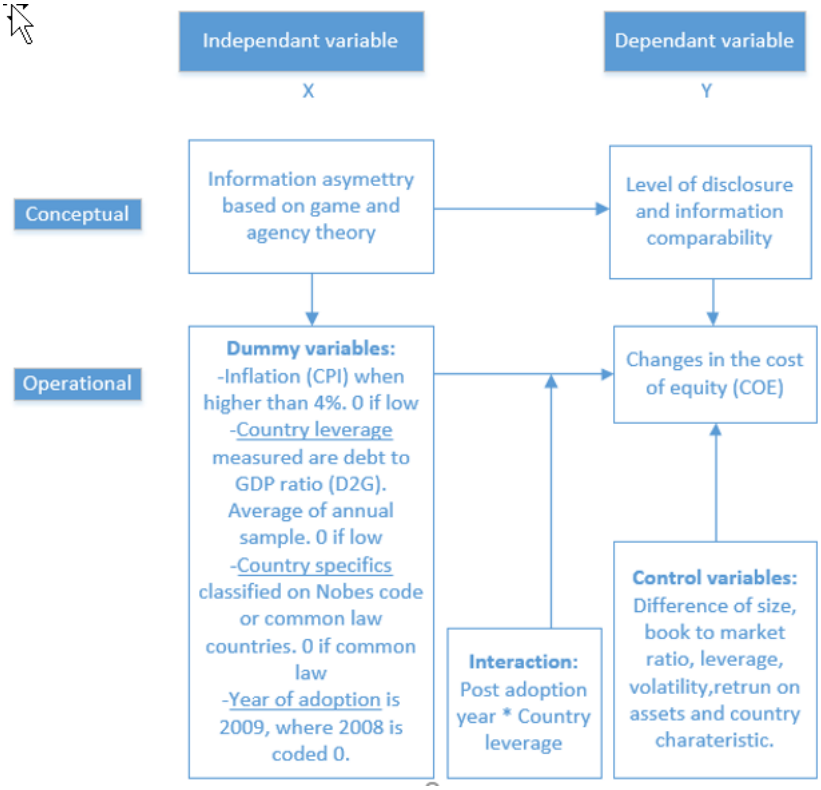
$$COE = \alpha_0 + \alpha_1 * Dummy\ for\ post\ adoption + \alpha_2\ Dummy\ for\ country\ leverage + \alpha_3\ Dummy\ for\ post\ adoption * Dummy\ for\ country\ leverage + \sum \alpha_j Controls_j + \varepsilon$$

With the interaction variable I will test whether if the amount of debt per country's GDP is of significant influence on the COE after IFRS 8 adoption. Economies and inflation differ greatly within the EU, and I expect that operating in a country that is heavily in debt will create more risk for shareholders investing in that country. I obtain the debt-to-GDP ratio from OECD database, and name it country leverage (D2G). I calculated the mean of 2008 and 2009 for 27 EU countries, and code countries with 1 if their rating is higher than the average and 0 when lower.

To conceptual model of the methodology I present figure 1, to explain the relationships to the independent variable the COE and among the dependant variables. The results of the linear relations are described in §4.4 data validation. The model will provide insight in the development of the COE prior and post adoption of IFRS 8 and help bring insight which characteristic has a significant impact on the COE.

Figure 1

Libby boxes that show insight in the conceptual model



§3.2 Sample

To test the effects on COE of the adoption of mandatory IFRS 8, a selection has been made regarding the inclusion of the EU country. The countries selected have a more acclaimed stock exchange, than the remainder of the EU states. This will provide more assurance and account for the majority of assets in the EU.

Currently the EU consist of 27 countries, see appendix B for a detailed list. This number is not consistent through the years, Bulgaria and Romania are the latest contribution to the EU as of the first January 2008. There have been 6 expansions over time, of which in the sample period, the year 2004 was most important. In that year the EU expanded with the countries; Cyprus, Estland, Letland, Lithuania, Malta, Hungary, Poland, Slovenia, Slovakia and the Czech Republic. From these countries, firms are selected that are listed in their primary stock exchange. The smaller countries will be disregarded as part of the EU in regard to the sample period. The reason to use a primary stock exchanges is arguable since the focus is on identifying the relation to the COE on national level. Local markets are more dependable on

the economic situation in their own country, which could validate the use of a GNP control variable more, as to firms which are operating on a global scale. Also data for firms listed in countries with smaller stock exchanges, is much more biased as the firms in those states are also subject to less legal enforcement (Li, 2007). Therefore, this research will limit to the firms listed in the stock exchanges as described in appendix B.

From Wharton I obtained 10176 companies that are currently active and inactive, for 25 EU countries with their SEDOL, IBES and ISIN identifier. With this dataset, I connect to the DataStream database to get the variables connected to these companies. Analysing the results, performance scores for Bulgaria, Cyprus, Estonia, Latvia, Lithuania, Malta, Romania and Slovenia are too low in regard of available data, especially on the earnings per share data. These countries have been removed from the sample, including 148 redundant companies from the other countries that did not get any identifier from the Wharton database. This left 9476 companies suited to start assessing the earnings per share data available. In order to calculate the COE, I checked available data for time series of 2008-2011. Should any EPS or share price data (2008-2009) be missing, the company is omitted from the sample. This resulted in a remainder of 2771 companies suitable for independent investigation.

The period under investigation is 2008-2009, therefore I have only one year prior mandatory adoption. As of September 2008 the start of the recession came with the fall of Lehman Brothers bank, I expect significant differences compared to the data prior to that year. As such, it would influence the results. The crisis according to Greenspan, already set in end of 2007. Companies were able to early adopt IFRS 8, and therefore the year 2008 may already consist of companies that are publishing this standard. However, as Li (2008) points out in his research, there was no significant impact to support the case that companies benefitted from this at the time of IFRS adoption. I assume it negatively impacts comparability between companies that have and have not adopted the standard. In respect to 2009, I will assume that every firm will have switched to IFRS 8 that year.

I removed companies that have recorded a COE of more than 100% from the sample, as it appears that the business they are operating in, are not suitable for the PEG-ratio. With a COE 100%, initially I would think of going concerns for many companies, possibly with exception of the pharma industry (where a 10 times return may still be possible). I checked the removed companies on validity and they still exist today, to support my selection argument. I also

removed companies with a negative leverage, extreme high leverage (one above 2000) or 0 leverage, as having negative/0 debt or assets is highly unique and not representable for the sample and. I also removed companies with a negative ROA and above 200. I expect these to not to be relevant to the population or have imperfect data.

In total I recorded 1795 company years. I continue to obtain data for the other variables, where values denominated in a different currency other than EUR are recalculated with an exchange rate at the end of that year. All other data is extracted in EUR with a synthetic exchange rate of USD. Table 1 shows an overview of the variables using in the regression model.

Table 1

Overview of variables and their source

Variable	Denomination	Description in database	DataType	Database
EPS	Number	EPS as reported	WC18193	Worldscope
Pt	Number	Unadjusted Price	UP#S	DataStream
IFRS	Number	AcctgStandardsFollowed	WC07536	Worldscope
VOL	Percentage	PriceVolatility	VOL + WC08806	DataStream +Worldscope
LEV	Number	TotalDebt /TotalCommonEquity	WC08231	Worldscope
SIZE (logarithm)	Number	TotalAssets	WC02999	Worldscope
BMR	Number	PriceToBookRatioClose	WC09304	Worldscope
ROA	Percentage	ReturnOnAssets	WC08326	Worldscope
CPI	Number	Inflation	FP.CPI.TOTL.ZG	Datastream

§3.3 Summary

In this chapter I explain the setup of the model, that is comparable to the study of Li (2008). For the sample I focussed on the primary stock exchanges in the EU, and disregarded the smallest and or weakest. With a difference in difference design I investigate the difference of the COE, measured by the Pennman modified PEG ratio, in the years 2008 and 2009. To help support my findings I use multiple control variables that are of influence to the COE and to the country. I included an interaction term to measure the impact of IFRS 8 when a country is relatively highly leveraged compared to the mean of the population.

Chapter 4 Empirical findings

To address my question, I looked at the trend of the COE between the year of adoption and before and if there is any relation to be found if countries that are above in debt have a significant different performance.

§4.1 Assumptions

With this thesis I try to find causality between the introduction of IFRS 8 and agency theory, with COE as proxy for information asymmetry. With an etic deductive approach data was gathered from the DataStream database I expect to find proof that IFRS 8 did not result to an increase in disclose and a reduction of information asymmetry that would lower the COE. As described in §3.5 evidence found by Nichols, Street and Cereola (2012), there is no evidence that IFRS 8 lead to more and/or comparable information. At least not to the extent the IASB was expecting, hence I am not expecting to find a significant reduction of the COE.

§4.2 Descriptive statistics

Table 1 presents the statistical values for the dependant variables. I find as result a COE that was higher prior to adoption of IFRS 8, see table 2.

Table 2

Results for the COE

Variable	Dpost	N	Mean	SE Mean	StDev	Minimum	Q1	Median	Q3	Maximum
COE	Post	779	2.326	0.037	1.037	0.151	1.442	2.452	3.137	4.602
	Pre	722	2.358	0.038	1.041	0.236	1.475	2.504	3.189	4.616

The mean shows an increase of the COE by 3 basis points, together with an increase in standard deviation and median over population of 779 prior and 772 observations after adoption. There were no observations omitted from the result.

With help a Tukey comparison I investigated whether the mean COE of the entire sample is significantly different between 2008 and 2009. This is not the case.

Table 3

Tukey pairwise comparison, grouping based on 95% confidence interval

Dpost-t	N	Mean	Grouping[2]

[2] Means that do not share a the same letter, are significantly different.

Post	777	2.36223	A
Pre	770	2.31824	A

The tables 4 to 6 also provides information on the effect of high or how Debt-to GDP (D2G) ratio, data obtained from the OECD. From the sample, most companies we have data of, reside in high G2D countries. What is difficult to explain that the COE in low G2D countries have a higher average COE to companies in the other countries. An possible explanation could be that there are other endogenous factors increasing risk for those companies. The lower than average D2G countries are: AUS, CZE, FIN, LUX, SVK, EST, SVN, LVA, LTU. These are relatively small countries with on average smaller economies that the average of high G2D countries and could be of more significance to what is considered risky for investors.

Table 4

Descriptive statistics to show the impact on the COE by level of a countries' debt

Variable	D2G	N	Mean	TrMean	StDev	Minimum	Q1	Median	Q3	Maximum
COE	High	1225	2.229	2.2241	1.077	0.1509	1.2403	2.3416	3.1321	4.6028
	Low	326	2.7637	2.7646	0.7412	0.7726	2.2695	2.7785	3.2382	4.6159

Table 5

*Descriptive statistics to show the impact on the COE in countries with **high** debt*

Variable	D2G-t	N	Mean	TrMean	StDev	Minimum	Q1	Median	Q3	Maximum
COE	Post	621	2.2409	2.2406	1.0791	0.1509	1.2605	2.3106	3.1383	4.6017
	Pre	604	2.2186	2.2071	1.0757	0.2361	1.23	2.3694	3.1317	4.6028

Table 6

*Descriptive statistics to show the impact on the COE in countries with **low** debt*

Variable	D2G-t	N	Mean	TrMean	StDev	Minimum	Q1	Median	Q3	Maximum
COE	Post	158	2.6614	2.6649	0.7646	0.7726	2.1863	2.7187	3.1374	4.5799
	Pre	168	2.8599	2.8551	70.74	0.8705	2.4022	2.8769	3.3195	4.6159

Between table 5 and I find a decrease in the mean COE for the countries classified with a low debt ratio and an increase with for the countries with a low debt ratio. It is visible that the

population is much smaller. While overall in table 4 the lower debt countries have a higher mean.

I perform a 2-sample, one tailed Z-test for high vs. low leveraged countries, to find support for my second hypothesis that low debt ratio country experience a lower COE.

Where $\overline{x_1} = 2.229, \sigma_1 = 1.077,\ n_1 = 1225\ and\ \overline{x_2} = 2.7636, \sigma_2 = 0.7412,\ n_1 = 326$

$Z = \frac{\overline{x_1} - \overline{x_2}}{\sqrt{\frac{{\sigma_1}^2}{n_1} + \frac{{\sigma_2}^2}{n_2}}} = -0.173717$ with a $Z_{crit} = -1.645$

With the outcome, I find that a Z-value above the critical value. This shows that the average COE of countries with a lower debt ratio is not lower than those with a high debt ratio. I run the test again with a 2-sample T-test, and first test for 2 variances on the entire data set with an F-test, that finds a significant difference in variance.

Table 7

2-Sample T, grouping based on 95% CI diff. (1.4967, 1.6079)				
	N	Mean	StDev	SE mean
COE	1551	2.34	1.04	0.026
D2G	1551	0.790	0.408	0.010

Difference = μ (COE_ln) - μ (D2G), Estimate for difference: 1.5523.
T-Test of difference = 0 (vs ≠): T-Value = 54.80 P-Value = 1.000 DF = 2016.

The T-test confirms the result not to reject the null hypothesis.

When investigating the dependent variables in the total sample, it becomes visible that PBV and CPI have a weak normal distribution. All dependable variables have been modified to improve the data as can be read in §4.1. the same becomes visible. The result of the data transformation is presented in table 4, where minimum and maximum are harmonized for both years for most of the variables. Still for the ROA there is a big difference visible on the mean as it almost tripled. I do not have an assumption how this shift is possible.

Table 8

Descriptive statistics per variable, distribution check

Variable	Count	Mean	TrMean	Stdev	Variance	Minimum	Q1	Median	Q3	Maximum	Skewness[3]	Kurtosis[4]
COE	1551	2.342	2.345	1.039	1.079	0.151	1.458	2.490	3.154	4.616	-0.140	-0.960
LEV	1551	3.675	3.803	1.733	3.004	-2.303	3.003	4.022	4.727	6.909	-1.250	2.100
PBV	1551	0.887	0.848	0.493	0.243	0.020	0.560	0.784	1.118	4.632	1.600	4.900
ROA	1551	3.022	2.854	7.053	49.738	-9.000	-0.630	3.250	7.160	19.000	0.030	-0.290
VOL	1551	-1.085	-1.087	0.421	0.177	-2.303	-1.372	-1.080	-0.816	-0.105	0.060	-0.060
TA	1551	5.680	5.679	0.960	0.921	3.200	5.029	5.639	6.324	7.800	0.070	-0.190
CPI	1551	0.086	0.040	0.281	0.079	0.000	0.000	0.000	0.000	1.000	2.950	6.690
D2G	1551	0.790	0.822	0.408	0.166	0.000	1.000	1.000	1.000	1.000	-1.420	0.030
Acct.cls	1551	0.585	0.595	0.493	0.243	0.000	0.000	1.000	1.000	1.000	0.350	-1.880
Dpost	1551	0.502	0.503	0.500	0.250	0.000	0.000	1.000	1.000	1.000	-0.010	-2.000

[3] As data becomes more symmetrical, its skewness value approaches zero. Normally distributed data, by definition, exhibits relatively little skewness (MiniTab 17).
[4] Normally distributed data establishes the baseline for kurtosis: not too flat, not too sharply peaked. Data that followed a normal distribution perfectly would have a kurtosis value of 0. Because significant kurtosis indicates that the data are not normal, you may think of the statistic as a first check for normality (Minitab 17)

Table 9

Descriptive statistics per variable, distribution check before and after introduction IFRS8

Variable	Dpost-t	Count	Mean	TrMean	Stdev	Variance	Minimum	Q1	Median	Q3	Maximum	Skewness	Kurtosis
COE	Post	779	2.326	2.333	1.037	1.075	0.151	1.442	2.452	3.137	4.602	-0.150	-0.970
	Pre	772	2.358	2.358	1.041	1.084	0.236	1.475	2.504	3.189	4.616	-0.130	-0.950
LEV	Post	779	3.684	3.808	1.702	2.895	-2.303	3.019	4.026	4.741	6.909	-1.230	1.970
	Pre	772	3.666	3.798	1.766	3.117	-2.303	2.957	4.001	4.691	6.909	-1.270	2.230
PBV	Post	779	0.824	0.786	0.474	0.224	0.020	0.495	0.708	1.044	3.202	1.390	2.730
	Pre	772	0.951	0.909	0.504	0.254	0.157	0.604	0.850	1.197	4.632	1.800	6.560
ROA	Post	779	4.451	4.414	6.897	47.567	-9.000	0.960	4.700	8.550	19.000	-0.130	-0.150
	Pre	772	1.579	1.290	6.917	47.845	-9.000	-2.998	1.850	5.318	19.000	0.210	-0.190
VOL	Post	779	-1.216	-1.221	0.402	0.162	-2.303	-1.498	-1.232	-0.973	-0.105	0.180	0.200
	Pre	772	-0.952	-0.953	0.397	0.157	-2.303	-1.213	-0.960	-0.691	-0.105	-0.020	-0.030
TA	Post	779	5.679	5.680	0.958	0.919	3.200	5.037	6.328	6.328	7.800	0.060	-0.190
	Pre	772	5.680	5.678	0.962	0.925	3.200	5.009	6.324	6.324	7.800	0.080	-0.180
CPI	Post	779	0.017	0.000	0.128	0.016	0.000	0.000	0.000	0.000	1.000	7.560	55.300
	Pre	772	0.157	0.118	0.364	0.132	0.000	0.000	0.000	0.000	1.000	1.890	1.580
D2G	Post	779	0.797	0.830	0.402	0.162	0.000	1.000	1.000	1.000	1.000	-1.480	0.190
	Pre	772	0.782	0.814	0.413	0.171	0.000	1.000	1.000	1.000	1.000	-1.370	-0.120
Acct.cls	Post	779	0.588	0.598	0.493	0.243	0.000	0.000	1.000	1.000	1.000	-0.360	-1.880
	Pre	772	0.583	0.592	0.493	0.243	0.000	0.000	1.000	1.000	1.000	-0.340	-1.890

With help of the Pearson-correlation matrix in table 9, I investigate how the independent variables are correlated to the COE. I find that TA and CPI are not correlated, which maybe explained by the fact that CPI is not normally distributed and can be an suppressor variable.

The top number signifies the Pearson correlation r, and the bottom the p value / significance level. I test for the absolute value $|r|$ above 0.632 to see if any significant correlation exists.

Table 10

Pearson correlation matrix	COE	LEV	PBV	ROA	VOL	TA	CPI	D2G	Acct.cls.
LEV	0.113								
P-value	0.000								
PBV	-0.242	0.014							
P-value	0.000	0.582							
ROA	-0.243	-0.103	0.334						
P-value	0.000	0.000	0.000						
VOL	0.186	-0.041	-0.080	-0.341					
P-value	0.000	0.107	0.002	0.000					
TA	0.021	0.347	0.031	0.235	-0.334				
P-value	0.411	0.000	0.221	0.000	0.000				
CPI	0.123	0.013	0.038	-0.028	0.096	0.004			
P-value	0.000	0.607	0.135	0.273	0.000	0.885			
D2G	-0.209	-0.067	-0.096	-0.091	-0.054	-0.061	-0.303		
P-value	0.000	0.008	0.000	0.000	0.033	0.017	0.000		
Acct.cls.	0.597	0.080	-0.078	0.057	-0.062	0.187	0.142	-0.158	
P-value	0.000	0.002	0.002	0.024	0.015	0.000	0.000	0.000	
Dpost	-0.015	0.005	-0.129	0.204	-0.313	0.000	-0.249	0.018	0.005
P-value	0.544	0.838	0.000	0.000	0.000	0.988	0.000	0.475	0.841

The company size (TA_w) has no significant correlation, which to me is unusual, as I do expect large firm to be subject to less risk, in comparison to say start-ups. Another example would be the bail out of financials, as those firms were in essence too big to fail. This could be an early sign of an active suppressor variable.In the robustness check paragraph I will test if the model outcomes are sustainable without the TA and CPI. In Minitab I execute the regression model:

$$COE = \beta 0 + \beta 1\, LEV + \beta 2\, PBV + \beta 3\, ROA + \beta 4\, VOL + \beta 5\, SIZE + \beta 6\, CPI + \beta 7\, Acct.cls. + \beta 8\, D2G * Dpost + \varepsilon$$

I correct the model for optimal λ according the Box-Cox technique and standardize the categorical variables Dpost and D2G to reduce the collinearity and skewness of the independent variables. I also have Minitab present an interaction plot on the effects for D2G*Dpost for countries with a high debt. The table and execution of the model can be found in appendix D.

Table 11

Analysis of variance					
Source	DF	Adj SS	Adj MS	F-Value	P-Value
Regression	10.000	360	35.980	158.580	0.000
LEV	1.000	2	1.717	7.570	0.006
PBV	1.000	9	9.290	40.950	0.000
ROA	1.000	18	18..28	80.340	0.000
VOL	1.000	13	13.023	57.400	0.000
Table 10	1.000	0	0.097	0.430	5.140
CPI	1.000	0	0.337	1.480	0.223
Acct.cls	1.000	235	234.622	1034.150	0.000
Dpost	1.000	4	3.599	15.860	0.000
D2G	1.000	2	1.761	7.760	0.005
*Dpost*D2G*	1.000	4	3.748	16.520	0.000

Table 12

Model summary of transformed response			
Predictor	Mean	StDev	
LEV	3.676	1.734	
PBV	0.887	0.493	
ROA	3.017	7.033	
VOL	-1.086	0.420	
TA	5.679	0.961	
CPI	0.087	0.281	
Acct.cls	0.586	0.493	
S	R-sq	R-sq (adj)	R-sq (pred)
0.476	50.80%	50.48	49.97%

Table 13

Coded coefficients with transformed response					
Term	Coef	SE coef	T-value	P-value	VIF
Constant	1.888	0	92.080	0.000	
LEV	0.037	0	2.750	0.006	1.200
PBV	-0.086	0	-6.400	0.000	1.220
ROA	-0.130	0	-8.960	0.000	1.430
VOL	0.107	0	7.580	0.000	1.360
TA	-0.009	0	-0. 650	0.514	1.410
CPI	-0.017	0	-1.220	0.223	1.250
Acct.cls	0.407	0	21.160	0.000	1.090
Dpost, pre	-0.119	0	-3.980	0.000	1.510
D2G, low	0.121	0	2.790	0.005	2.120
*Dpost*D2G*	0.248	0	4.060	0.000	1.440

The result of the regression model is significant, where $F(10, 1536) = 158{,}59, p < 0.001, R^2 = .51$ it functions as a good predictor on COE.

§4.3 Robustness check

To substantiate my findings I apply a one-tailed lower Z-test to validate my research question, where my hypothesis were formulated as: $H_{0} = \mu_{COE2008} - \mu_{COE2009} \geq 0$ as the current paradigm is that IFRS 8 reduced information asymmetry and reduced the COE in 2009, and $H_{a} = \mu_{COE2008} - \mu_{COE2009} < 0$.

Table 14

One-sample Z, test μ=2.3582 vs < 2.3582 with σ = 1.0366					
N	Mean	SE mean	95% upper	Z	P
779	2.326	0.037	2.387	-0.86	0.194

The z-test is not significant with a P-value of 0.194, and a Z-score on $\alpha = 0.05$ is -0.86, I cannot reject the null hypothesis, as the values do not show a significant increase in the COE. To further strengthen the validity of the model, first I regress with CPI -omitted and then with CPI and TA variable omitted. I have included these variables intending to capture potential confounding factors as I believe CPI and TA are material to what can be seen for investor as risk, and what to see priced in the COE. The full details of this check are available in appendix F. A snapshot of the results visible in figure 1, and show no significant alteration to

the predictability of the model. It validates that the model not strongly accounted for CPI and TA differences and contradicts my earlier assumptions. However also displays strong correlation in the other independent variables, that uphold the predictability of the model.

Table 15

Model summary of transformed response without TA & CPI					
S	R-sq	R-sq (adj)	R-sq (pred)		
0.478	50.73%	50.48%	50.08%		
Term	Coef	SE coef	T-value	P-value	VIF
Constant	2.659	0.053	50.080	0.000	
LEV	0.019	0.007	2.720	0.007	1.03
PBV	-0.172	0.027	-6.350	0.000	1.21
ROA	-0.019	0.002	-9.340	0.000	1.36
VOL	0.262	0.033	8.110	0.000	1.24
D2G, low	0.117	0.043	2.700	0.007	2.11
Acct.cls	-0.821	0.025	-32.450	0.000	1.05
Dpost, pre	0.248	0.029	-4.320	0.000	1.45
*Dpost*D2G*	0.233	0.060	3.890	0.000	2.33

I also check if the model upholds without two relevant independent variables. I test the model omitted with ROA and VOL, two that are positively correlated to the COE and considered relevant to the model.

Table 16

Model summary of transformed response without ROA & VOL					
S	R-sq	R-sq (adj)	R-sq (pred)		
0.486	45.39%	45.10%	44.64%		
Term	Coef	SE coef	T-value	P-value	VIF
Constant	2.662	0.093	27.74	0.000	
LEV	0.041	0.008	5.38	0.000	1.14
PBV	-0.285	0.026	-11.14	0.000	1.04
TA	-0.086	0.014	-6.19	0.000	1.17
CPI	0.054	0.049	1.10	0.271	1.25
D2G, low	0.131	0.044	2.96	0.003	2.10
Acct.cls	-0.785	0.026	-30.01	0.000	1.09
Dpost, pre	0.020	0.083	0.72	0.471	1.31
*Dpost*D2G*	0.221	0.062	3.54	0.000	2.43

The predictability drops 5%, which I consider minimal under circumstances.

§4.4 Analysis

Based on the data I accept the null hypothesis, there is no significant evidence to support the alternative, where IFRS 8 did not lead to a significant reduction of information asymmetry and a lower COE. Data showed a reduction of the mean COE from 2008 to 2009, that was valued as non-significant. This observation may therefore not be attributed to the implementation of IFRS 8. There is also no evidence that a country with average lower debt has a lower COE. Findings show for this period signs this may be the other way around.

In regard to the model, for leverage, price-to-book value, return on assets, volatility, accounting and accounting class, I find a significant relationship between these variables and the COE. It is strange to find no significant relationship for size and inflation. I expect another factor to overshadow these variables, that may not account enough for the financial crisis that is applicable to both years. A strong relationship does appear when executing the single regression with these variables by itself. This could be the effect of a suppressor, where one or multiple variables are correlating to these two. I am positive these two are influencer of risk and are relevant to the pricing of COE. Omitting them both marginal yields to a better model and proved robust.

I also find there is a relation between of a country's debt on the year 2008 and 2009. I included the interaction to find evidence that the crisis, of which I use a country debt as proxy, will have a significant impact on the investigation and therefore to be relevant to the model. Data shows a positive effect for both years, meaning that increasing the debt will increase the COE, but the interaction shows this increase is even higher.

In order to explain these results, I look at the study of Aleksanyan & Danbolt (2015) as well as Nichols et al. (2012) to find supporting evidence of my findings, that there was a significant decline in the number of reportable segments as segment data. This is in combination with a reduction in comparability in non-IFRS and profitability measures, attributed by the introduction of IFRS in 2009, and supports my findings to an increase in information asymmetry and higher COE. The assumption was to record a possible increase of the COE.

§4.5 Summary

The paradigm that increased disclosure, reduction of information asymmetry, should lead to a lower COE was tested for the introduction of IFRS 8. A difference in difference model was created, where the COE was used as a proxy for measuring the effect on 812 EU companies, counting for 1552 firm years. Controlling for size, leverage, volatility, inflation, price-to-book value and return on assets, as a result I found a no significant decrease of the COE. This finding was supported by earlier research, that found no evidence that IFRS 8 lead to improved disclosure and a reduction of information asymmetry.

Chapter 5 Conclusion

The IASB has embedded many revisions since the introduction of IFRS, by updates and new standards. The effects are that IFRS is gradually harmonizing more and more with SFAS. The IASB would view this as an opportunity to improve segment disclosures, value relevance of segmental data and reduction of preparation costs for the company IFRS 8 is such an example, with its introduction of the managerial approach.. This because the report would help investors see the company through the eyes of management (Aleksanyan & Danbolt, 2015).

To complete my masters in Accounting, Auditing & Control, I investigate the impact of the introduction of IFRS 8 in the European marked with listed companies in the year 2008 and 2009 on the COE. The COE is a proxy of information symmetry. Based on the agency theory, I assume that the introduction of IFRS 8 generated more transparency, comparability and details on segment reporting in a companies' financial statement. Increased disclosure would reduce risk for investors, and would therefore accept a lower compensation on their investment.

IFRS 8 was introduced during the financial crisis in 2009. I believe this to have had a significant impact to shareholder's risk and I am interested if this transposed in the COE. It gives me the opportunity to investigate if firms operating in countries with a lower debt ratio are more likely to benefit from a lower COE.

§5.1 Conclusions

This thesis has many similarities to the research of Li (2008). It was focused on the introduction of IFRS in the EU. Prior to the introduction of IFRS there was much debate on the effects and merit of IFRS. Ultimately, there was consensus that IFRS did bring increased disclosure, and less information asymmetry, which was visible in a lower COE. This would also apply for segment reporting (Leuz, 2004).

I want to test if the assumptions of the IASB were correct, that IFRS 8 would bring significant benefits by increased disclosure, improve comparability and reduce information asymmetry. And investigate if firms operating in countries with a lower debt ratio are more likely to benefit from a lower COE. For this I developed the following hypothesis:

H0: I*mplementation of IFRS 8 in the EU, lead to a decrease of the COE and* H0: *Countries with a below average debt ratio do not have a lower COE.* And the alternative:

H1: *Implementation of IFRS 8 in the EU, did not lead to decreased COE and* H1: *Countries with a below average debt ratio have a lower COE.*

I found strong results that the introduction did not lead to a significant reduction of asymmetry, but a slight COE decrease of 3.2 basis points. This result is supported by the research of Nichols et al. 2012 and Aleksanyan & Danbolt, 2015. They found evidence that there was an increase in segments. However a decrease of segment items and comparability of profit- and non-IFRS measures, that would negatively impact significant improvements. There was no other supporting evidence, from the research addressed in chapter 3, that IFRS 8 significantly reduced information asymmetry or increased decision usefulness in such a way that it would increase the level of disclosure in comparison to IAS14. Also my research did not find a significant reduction or decease of the COE between 2008 and 2009, which does not support me to reject the null hypothesis. Which is unfortunate as this was achieved by the introduction of IFRS back in 2001, and may be early signs that harmonizing with SFAS may not be as beneficial as expected. However more reaching will need to be done on this topic.

I also tested if the countries level of debt has any influence of the COE, pre and post adoption. There I find strong evidence that firms on average with a higher COE are residing in lower debt-to-GDP ratio countries. Also that the COE in those countries are lower adoption of IFRS 8, while other are effected with a higher COE.

§5.2 Limitations

Arguably, by using the PEG-ratio to calculate the COE, this selection represents companies that are stable. As they were able to grow in the first 2 years of the crisis, therefore may represent a sample with low risk, and not a fair sample of the total population. However, “there is no reason to say that these assumptions could materially affect our COE capital comparisons” (Lee et al. 2008). There are multiple calculation methods available, I only used one. Using multiples would strengthen my findings.

There was also no dummy incorporated for industry specifics. The results could therefore be biased, as these could be the explanation for the results found in the COE. However I do

apply the Nobes classification, that to a lesser extent controls for these factors. Also Hail and Leuz (2007) don't include industry controls because Fama and French (1997) find that there is substantial variation in factor loading across industries. By doing so you are controlling for *"differences in macroeconomic variations and country's exposure to global economic risks and shocks"* (Ferson and Harvey, 1998). Nor is it my ambition to test the relationship of industry characteristics and the effect on the cost of capital as many firm characteristics are correlated with origin of their industry membership.

The model displays perhaps a little non-normality. This may disappear if the COE is transformed to display more linearity. The residuals appear to be randomly scattered, no increasing variance, but possible some curvature due to outliers. By using a large sample size I try to reduce the standard- and sampling error as much as possible.

I cannot ignore the credit crunch of past years; I believe this surpasses the inflation control mechanism explained earlier. Especially due to the ECB' monetary policy, which exploits a hard-nosed policy preference (De Grauwe, 1996), aimed at containing inflation rates. The credit crunch resulted in a drop of share-prices starting in the U.S and further across the world. Due to complex derivatives (special purpose vehicles, SPV) which contained a lot of resold mortgages. More and more families starting the default on their mortgage loan, which than affected the financial sector and the rest is common knowledge. This affected the E.U. as well, e.g. by a detrimental effect on stock prices. By not containing this event the results in the years 2008-2009 would be misleading. By reading Greenspan (2010) the start of the bubble was supposedly in August 2007. Because of this I only focus on the year before and after adoption. Lengthening the period before and after adoption would strengthen this thesis.

In succession of the crisis in 2008, I am aware the firms' price-earnings ratios and stock prices are in an unusual state and may therefore influence the outcome. It would merit this study to use multiple techniques to calculate the COE. It is difficult to empirically measure the COE capital. Various models and techniques are described to give more insight into this subject. In this study the PEG-ratio is used to calculate the COE. The use of the COE calculation methods has limitations, which results in a lot of non-auditable observations which could alter the outcome of this research. Since all stock exchange listed firms are affected by the IFRS mandate, there is no control group to offset the results.

There is limited research available where individual updates or introductions of IAS or IFRS and their effect on information asymmetry. In general, there is more available on value relevance. With this thesis as small contribution is made, however more research is needed.

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Appendix A: Literature summary

Author	Object of study	Sample	Methodology	Outcome
Leuz & Verrecchia (2000)	Effects of German firms that have adopted IAS or U.S. GAAP standards in their consolidated financial statements.	N=90 1998	Event study with cross-sectional analysis of bid-ask spreads, share price volatility & share turnover	"Evidence is consistent with the notion that firms committing to increased levels of disclosure garner economically and statistically significant benefits".
Armstrong, Barth, Jagolinzer & Riedl (2006)	Examines the European stock market reaction to key events surrounding the adoption of International Financial Reporting Standards (IFRS) in Europe.	16-events All public firms in EU 2002-2005	Event-study methodology based on three-day market-adjusted returns (*MACRe*) from the Dow Jones STOXX Global 1800 Index	"They find significant positive (negative) market reactions to events that increased (decreased) the likelihood of IFRS adoption"
Daske, Hail, Leuz & Verdi (2008)	Examination of mandatory adaption of IFRS around the world based on the effects of market liquidity, cost of capital and Tobin's q	26 countries where it is mandatory to adapt to IFRS 3100 firms 2001-2005	Event study with cross-sectional variation with firm-year panel regression/data analysis	Market liquidity (3-6%)increases around time of introduction Cost of capital decreases by 26 basis points and an increase in equity valuations. Tobin's q increases 7%, conditions: • Strong legal enforcement • Incentive to be transparent Benefits are greater when voluntary adoption is applied
Daske (2006)	Investigate effects (IAS/ IFRS or US-GAAP) reduce the cost of capital for adopting German firms	13,000 HGB, 4,500 IAS/IFRS and 3,000 US-GAAP firm-month observ. 1993-2002	Empirical implementations of the residual income valuation model (RIV, Gebhardt, Lee and Swaminathan, 2001; and Easton, Taylor, Shroff and Sougiannis, 2002) and of the abnormal earnings growth model (AEG, Gode and Mohanram, 2003; and Easton 2004),	"No supporting empirical evidence, or overall results would rather suggest higher cost of equity capital for firms reporting under non-local standards during the transition period".
Dargenidou, McLeay & Raonic (2006)	Whether differences between accounting regimes lead to biased expected earnings that may have cost of capital effects in EU.	11,395 firm-year observ. N=107 1994-2003	Abnormal Earnings Growth equity valuation model of Ohlson and Juettner-Nauroth (2005) pricing methodology based on 3 assumptions	"It is shown empirically that accounting diversity is likely to be of little importance in integrating financial markets and the switch to internationally recognized GAAP is shown here to entail at least short-lived costs".
Li (2008)	Mandatory adoption of IAS in the EU leads to a reduction on the cost of capital.	N=1084 EU firms In 18 countries T= 1995-2006 6456 observations	Implied cost of capital models of: • Gebhard et al. (2001) industry ROE model • Claus & Thomas (2001) eco-wide growth model • Gode & Mohanram (2003) unrestricted abnormal growth • Easton (2004) restricted abnormal growth model primary analysis consists of regressing the cost of equity on a dummy variable indicating the type of adopter (mandatory versus voluntary), a dummy variable indicating the time period (pre- versus post-mandatory adoption period), the interaction between these two dummies, and a set of control variables.	"Mandatory adopters reduces cost of capital by 48 basis point. Voluntary adopters has no effect. The condition is strong legal enforcement, enhanced disclosure and comparability".
Christensen, Lee Walker (2007)	Examine the economic consequences of mandatory adaption (2005) of IFRS in UK. Focused on choices made by German firms where adaption of IFRS was a matter of choice since 1998 • Short term price response to news on IFRS adoption • Changes in long-run implied cost of capital	Country=UK N=52, listed companies	Use of the observed voluntary GAAP choices of German firms to predict which UK firms would be more likely to adopt IFRS given the same choice with a logic regression model: development of counter-factual proxy for formulae Calculation of the Sefcik and Thompson (1986) portfolio-weighting approach commonly used to test the effect of firm characteristics on stock market reaction to time clustered events (e.g., Comprix et al., 2003; Li, Pincus, and Rego, 2004) Calculation of the implied cost of equity capital based on the Ohlson and Juettner-Nauroth (2005) abnormal earnings valuation model and the Easton (2004) and PEG model.	• Finds evidence that the stock-price reaction of UK firms to announcements favourable (unfavourable) to mandatory IFRS adoption is positively (negatively) related for UK firms' willingness to adopt IFRS. • Mandatory IFRS has a different effect on the cost of capital depending on firm characteristics. Firms with similar characteristics to German voluntary adopters have greater benefits from international accounting harmonization and in particular from mandatory IFRS adoption. • Commitments made in one country can be used to predict the economic consequences of mandatory regulation in another country. Of course, some determinants may be less transferable from Germany to the UK, given the fact that the two countries investigated differ in their approach to accounting regulation this study suggests that relative benefits are at least partly explained by firm-specific factors.

Hail & Leuz (2007)	Investigation of capital-market benefits from the adoption of IFRS in the EU, based upon 3 arguments: • Existence of externalities • Economy-wide cost savings • Stricter sanctions for firms	5683 EU firms 2001-2005	Based upon 4 dependent variables/proxies: • Modified PER-ratio, Easton (2004) for cost of capital, with 2 yr. share-forecasts + expected dividends. • Bid-Ask spread, Welker (1995), • Illiquidity metric, Amihud (2002) • Proportion of zero daily returns, Lesmond,Ogden & Trzcinka (1999)	"Empirical analysis provides a mixed picture for the capital-market effects of mandatory IFRS reporting in the EU. The descriptive analyses do not indicate major structural breaks or changes in the capital-market variables, suggesting that the effects of IFRS reporting are likely to be modest".
Cuijpers & Buijink (2005)	Examines the determinants and consequences of voluntary adoption of non-local GAAP by firms listed and domiciled in the EU	N=224 1999	Inspection of the annual reports of possible US GAAP adopters with 3 proxies for information asymmetry: analyst following, cost of equity capital, and uncertainty among analysts and investors. Wilcoxon two-sample tests, Pearson and Spearman correlation and Easton et al. model	"Firms voluntarily using nonlocal GAAP are more likely to be listed on a US exchange, are more likely to be domiciled in a country with lower quality financial reporting and where IAS is explicitly allowed as an alternative to local GAAP. Also positive effect of non-local GAAP adoption on analyst following, but fail to find evidence of a lower cost of capital for non-local GAAP adopters".
Barth, Landsman, Lang and Williams (2006)	If application of IAS results in accounting amounts that are of quality comparable to that resulting from application of US GAAP	Cross listed non US IAS firms and US firms. N=429 1990-2004	Value relevance measure of regression of stock price on earnings and equity book value. Earnings management measure is based on the variability of change in net income scaled by total assets.	"No clear pattern of differences in quality between IAS-based accounting amounts and those based on reconciled US GAAP. Results indicate that IAS firms have lower accounting quality than US firms. In particular, IAS firms have a significantly lower variance of change in net income, a lower ratio of the variances of change in net income and change in cash flows, a significantly more negative correlation between accruals and cash flows, and a higher frequency of small positive net income".

Appendix B: Treatment sample

Unfortunately the historic research data available through at the DataStream database on stock index level was limited, so choices had to be made in which firms to include in a country. Normally this is deviated from a primary stock index listed in that country. Countries where this was not available, a best selection was made based upon representability and compatibility.

"NLD","AUT","BEL","BGR","CYP","CZE","DNK","EST","FIN","FRA","DEU","GRC","HUN","IRL","ITA","LVA","LTU","LUX","MLT","NLD","POL","PRT","ROU","SVK","SVN","ESP","SWE","GBR")

NLD,AUT,BEL, BGR, CYP, CZE, DNK, EST, FIN, FRA, DEU, GRC, HUN, IRL, ITA, LVA, LTU, LUX, MLT, NLD, POL, PRT, ROU, SVK, SVN, ESP, SWE, GBR

Treatment sample, period 2007-2009		
Country	Stock index (DS)	Legal system
Austria	WBI	Code, civil law
Belgium	BEL20	Code, civil law
Bulgaria	BG40	Code, civil law
Cyprus	CSE (selection)	Code, civil law
Czech Republic	PX 50 index	Code, civil law
Denmark	OMX Copenhagen 20	Code, civil law
Estonia	OMX Tallinn	Code, civil law
Finland	Fox index	Code, civil law
France	CAC40	Code, civil law
Germany	DAX	Code, civil law
Greece	NON-FINANCIAL GR	Code, civil law
Hungary	BUX	Code, civil law
Ireland	ISEQ 20	Common
Italy	S&P/MIB	Code, civil law

Latvia	OMX Riga	Code, civil law
Lithuania	OMX Vilnius	Code, civil law
Luxembourg	LUXXX	Code, civil law
Malta	MSE	Code, civil law
Netherlands	AEX	Code, civil law
Poland	MIDWIG 40	Code, civil law
Portugal	PSI 20	Code, civil law
Romania	BET	Code, civil law
Slovakia	Research SX	Code, civil law
Slovenia	Non-financials	Code, civil law
Spain	IBEX 35	Code, civil law
Sweden	OMX Stockholm 30	Code, civil law
United Kingdom	FTSE 100	Common

Appendix C: Accounting standard Codes WS

All Industries:

01 Local standards

02 International standards

03 U.S. standards (GAAP)

04 Commonwealth countries standards

05 EU standards

06 International standards and some EU guidelines

07 Specific standards set by the group

08 Local standards with EU and IASC guidelines

09 Not disclosed

10 Local standards with some EU guidelines

11 Local standards – inconsistency problems

12 International standards – inconsistency problems

13 US standards – inconsistency problems

14 Commonwealth standards – inconsistency problems

15 EEC standards – inconsistency problems

16 International standards and some EU guidelines – inconsistency problems

17 Local standards with some OECD guidelines

18 Local standards with some IASC guidelines

19 Local standards with OECD and IASC guidelines

20 US GAAP reclassified from local standards

21 Local standards with a certain reclassification for foreign companies

22 Other

23 IFRS

Appendix D: Minitab v18, Regression

Method: Stat → Regression → Regression → Fit regression model

```
Method

Categorical predictor coding  (1, 0)
Rows unused                   4

Box-Cox transformation
Rounded λ                     0.766921
Estimated λ                   0.766921
95% CI for λ                  (0.687421, 0.848421)

Continuous predictor standardization
Subtract the mean, then divide by the standard deviation

Predictor       Mean    StDev
LEV_ln       3.67554  1.73381
PBV_ln       0.88717  0.49298
ROA_w        3.01683  7.03332
VOL_ln      -1.08566  0.41990
TA_w         5.67903  0.96053
CPI          0.08662  0.28137
Acct.cls.    0.58565  0.49277


Analysis of Variance for Transformed Response

Source             DF   Adj SS   Adj MS  F-Value  P-Value
Regression         10  359.799   35.980   158.59    0.000
  LEV_ln            1    1.717    1.717     7.57    0.006
  PBV_ln            1    9.290    9.290    40.95    0.000
  ROA_w             1   18.228   18.228    80.34    0.000
  VOL_ln            1   13.023   13.023    57.40    0.000
  TA_w              1    0.097    0.097     0.43    0.514
```

CPI	1	0.337	0.337	1.48	0.223
Acct.cls.	1	234.622	234.622	1034.15	0.000
Dpost-t	1	3.599	3.599	15.86	0.000
D2G-t	1	1.761	1.761	7.76	0.005
Dpost-t*D2G-t	1	3.748	3.748	16.52	0.000
Error	1536	348.478	0.227		
Total	1546	708.277			

Model Summary for Transformed Response

S	R-sq	R-sq(adj)	R-sq(pred)
0.476313	50.80%	50.48%	49.97%

Coded Coefficients for Transformed Response

Term	Coef	SE Coef	T-Value	P-Value	VIF
Constant	1.8881	0.0205	92.08	0.000	
LEV_ln	0.0366	0.0133	2.75	0.006	1.20
PBV_ln	-0.0855	0.0134	-6.40	0.000	1.22
ROA_w	-0.1296	0.0145	-8.96	0.000	1.43
VOL_ln	0.1072	0.0141	7.58	0.000	1.36
TA_w	-0.0094	0.0144	-0.65	0.514	1.41
CPI	-0.0165	0.0136	-1.22	0.223	1.25
Acct.cls.	0.4065	0.0126	32.16	0.000	1.09
Dpost-t					
PRE	-0.1186	0.0298	-3.98	0.000	1.51
D2G-t					
LOW	0.1210	0.0434	2.79	0.005	2.12
Dpost-t*D2G-t					
PRE LOW	0.2483	0.0611	4.06	0.000	2.44

Regression Equation in Uncoded Units

Dpost-t D2G-t

POST HIGH COE_ln^0.766921 = 1.8747 + 0.02109 LEV_ln - 0.1734 PBV_ln - 0.01843 ROA_w + 0.2552 VOL_ln - 0.0098 TA_w - 0.0587 CPI
+ 0.8249 Acct.cls.

POST LOW COE_ln^0.766921 = 1.9956 + 0.02109 LEV_ln - 0.1734 PBV_ln - 0.01843 ROA_w + 0.2552 VOL_ln - 0.0098 TA_w - 0.0587 CPI
+ 0.8249 Acct.cls.

PRE HIGH COE_ln^0.766921 = 1.7561 + 0.02109 LEV_ln - 0.1734 PBV_ln - 0.01843 ROA_w + 0.2552 VOL_ln - 0.0098 TA_w - 0.0587 CPI
+ 0.8249 Acct.cls.

PRE LOW COE_ln^0.766921 = 2.1253 + 0.02109 LEV_ln - 0.1734 PBV_ln - 0.01843 ROA_w + 0.2552 VOL_ln - 0.0098 TA_w - 0.0587 CPI
+ 0.8249 Acct.cls.

Fits and Diagnostics for Unusual Observations

Original Response

Obs	COE_ln	Fit
11	1.3709	2.1019
21	3.6661	1.8461
46	1.8713	1.5636
55	4.5799	2.5255
129	1.5739	3.1741
145	3.1076	1.3326
169	4.1518	2.2641

213	4.0541	2.3764
229	2.2430	3.2589
247	0.3196	1.6694
260	2.4818	3.0369
262	1.1495	3.5320
283	3.8226	2.1996
288	0.8705	2.8345
294	0.5248	1.9218
296	4.1683	2.0348
306	1.3124	2.7881
309	0.2766	2.6928
345	0.8084	2.2453
356	3.6701	1.7266
426	3.0373	1.3324
453	3.3739	1.1870
474	0.4573	2.0670
481	4.2066	2.0204
540	3.5902	1.4961
554	4.5241	2.0129
564	0.3415	1.7475
609	3.9030	1.6546
626	1.0554	3.4481
633	3.4720	1.6417
638	3.9962	1.7729
640	1.2694	2.7767
645	3.5501	1.5400
678	0.4736	1.7559
697	3.2373	1.6686
751	3.1972	1.6500
752	1.5284	3.2311
779	2.6475	2.9529
806	3.7800	1.2604
809	3.2663	1.4742
814	0.5878	1.9622
821	1.0439	2.5244

869	4.4452	1.5742
874	3.9151	2.0255
887	4.3479	2.1451
891	3.7383	2.0637
896	1.1977	2.7809
905	3.8357	2.0683
911	3.5759	1.8367
933	4.6028	2.1790
934	0.7529	3.1106
940	1.4961	1.4797
951	1.3424	0.4527
958	3.0357	1.5077
965	3.3225	1.4801
969	2.9822	2.9240
982	3.9693	1.5730
984	2.5126	1.0064
994	3.2249	1.4322
995	4.0997	1.8410
998	3.2487	1.5581
1000	3.9120	1.8106
1011	3.8709	2.2446
1059	1.5615	3.0946
1096	3.0711	1.4146
1124	3.1630	1.2883
1125	4.2004	2.1210
1126	4.4785	2.7800
1151	0.2230	1.7824
1164	2.9399	1.2722
1165	0.2080	1.4390
1172	1.6677	0.7600
1180	3.6789	1.9532
1193	3.2477	1.6278
1197	3.8022	1.7575
1201	4.2487	2.5109
1204	3.4789	1.9268

1207	3.4958	1.8199
1218	3.5731	1.6964
1236	3.5084	1.7292
1247	4.2655	1.9047
1287	1.7079	3.3911
1303	1.2871	2.8167
1371	0.2114	1.4485
1379	0.7242	2.6078
1381	2.9861	1.3581
1417	4.1810	2.4308
1429	0.1509	1.2062
1432	2.7841	3.0433
1444	3.0387	1.0208
1456	3.8135	1.3365
1457	3.3657	1.0568
1466	3.0390	1.1376
1468	0.8644	2.6662
1482	1.7239	3.5072
1532	3.4722	1.5330
1535	3.2309	1.2470
1536	4.1580	1.3907
1549	3.3548	1.6219

Transformed Response

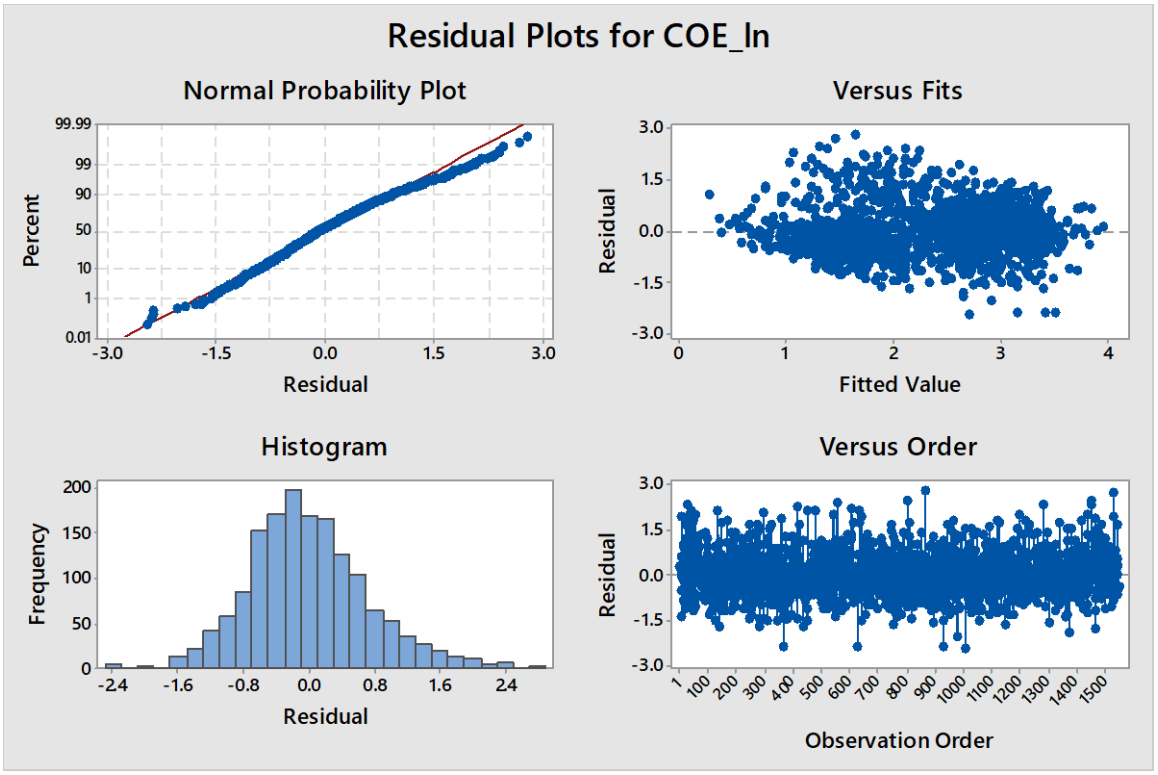
Obs	COE_ln'	Fit	Resid	Std Resid		
11	1.2737	1.7677	-0.4940	-1.05		X
21	2.7083	1.6003	1.1080	2.34	R	
46	1.6170	1.4089	0.2081	0.44		X
55	3.2124	2.0350	1.1773	2.49	R	
129	1.4160	2.4250	-1.0089	-2.13	R	
145	2.3859	1.2463	1.1395	2.43	R	X
169	2.9794	1.8715	1.1080	2.33	R	
213	2.9256	1.9422	0.9833	2.08	R	

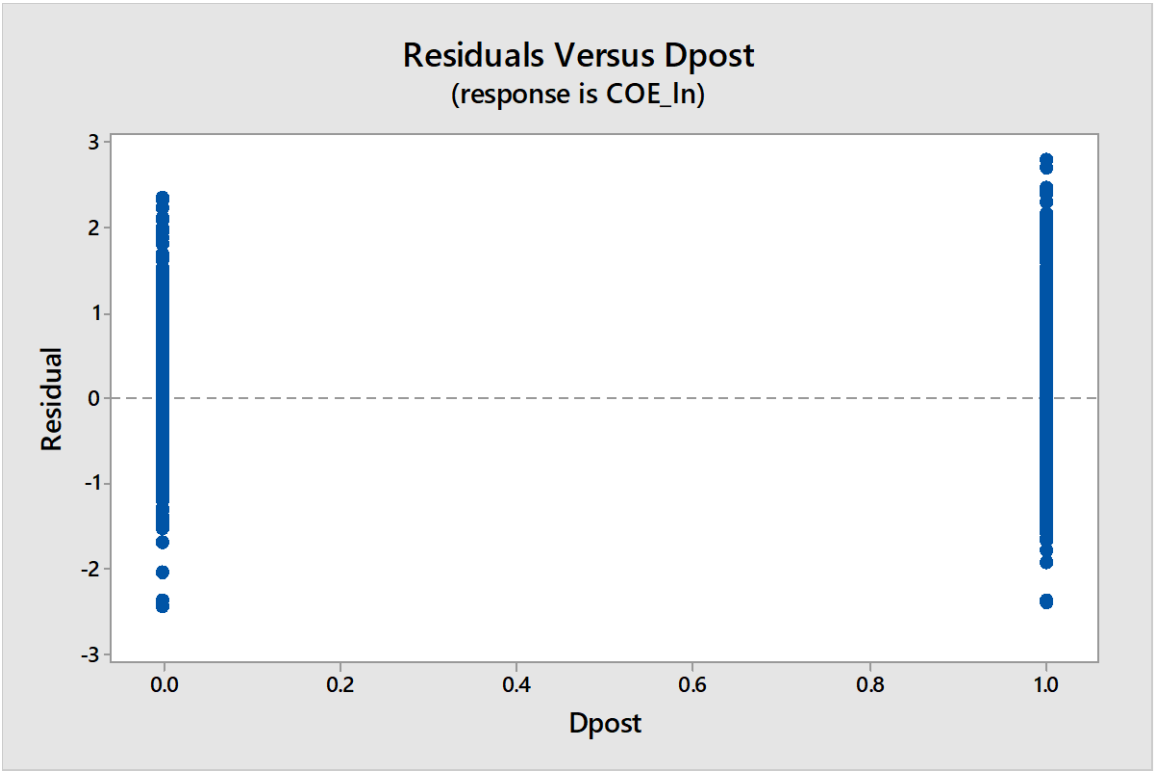
229	1.8581	2.4745	-0.6164	-1.31		X
247	0.4170	1.4815	-1.0645	-2.24	R	
260	2.0080	2.3442	-0.3362	-0.72		X
262	1.1128	2.6320	-1.5193	-3.21	R	
283	2.7965	1.8304	0.9661	2.04	R	
288	0.8991	2.2234	-1.3243	-2.80	R	
294	0.6099	1.6504	-1.0405	-2.19	R	
296	2.9885	1.7243	1.2643	2.67	R	
306	1.2318	2.1954	-0.9636	-2.03	R	
309	0.3733	2.1376	-1.7644	-3.71	R	
345	0.8495	1.8595	-1.0100	-2.13	R	
356	2.7106	1.5202	1.1903	2.51	R	
426	2.3444	1.2462	1.0982	2.32	R	
453	2.5412	1.1405	1.4007	2.97	R	X
474	0.5488	1.7452	-1.1964	-2.52	R	
481	3.0096	1.7149	1.2947	2.73	R	
540	2.6652	1.3620	1.3032	2.77	R	X
554	3.1823	1.7101	1.4722	3.10	R	
564	0.4387	1.5343	-1.0956	-2.31	R	
609	2.8416	1.4714	1.3702	2.88	R	
626	1.0422	2.5839	-1.5417	-3.25	R	
633	2.5977	1.4625	1.1351	2.39	R	
638	2.8935	1.5514	1.3421	2.83	R	
640	1.2007	2.1885	-0.9878	-2.08	R	
645	2.6423	1.3926	1.2498	2.65	R	
678	0.5637	1.5400	-0.9762	-2.06	R	
697	2.4619	1.4809	0.9810	2.07	R	
751	2.4385	1.4683	0.9702	2.05	R	
752	1.3845	2.4583	-1.0738	-2.26	R	
779	2.1100	2.2942	-0.1843	-0.39		X
806	2.7726	1.1942	1.5784	3.32	R	
809	2.4788	1.3467	1.1322	2.38	R	
814	0.6653	1.6769	-1.0116	-2.13	R	
821	1.0335	2.0344	-1.0008	-2.11	R	
869	3.1397	1.4162	1.7235	3.62	R	

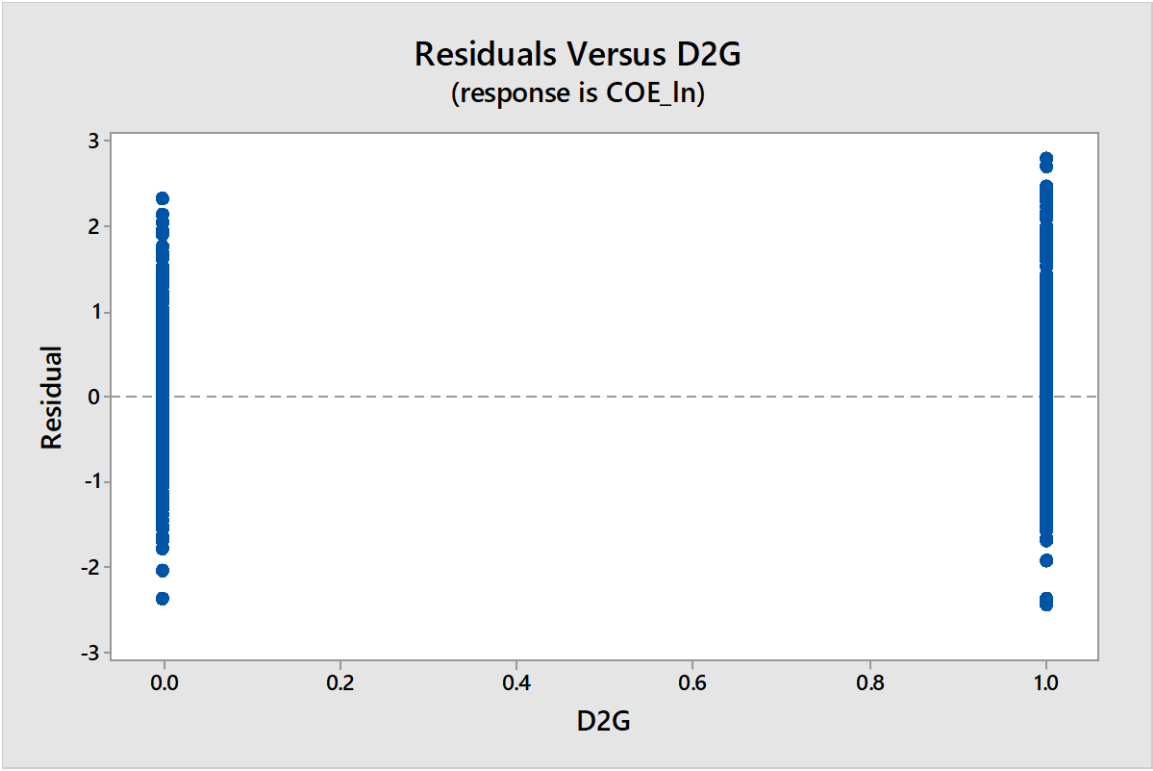
874	2.8483	1.7183	1.1300	2.38	R	
887	3.0868	1.7956	1.2912	2.72	R	
891	2.7492	1.7431	1.0061	2.13	R	
896	1.1484	2.1910	-1.0426	-2.20	R	
905	2.8039	1.7460	1.0579	2.23	R	
911	2.6571	1.5940	1.0630	2.24	R	
933	3.2247	1.8172	1.4074	2.96	R	
934	0.8044	2.3877	-1.5833	-3.35	R	
940	1.3620	1.3505	0.0115	0.02		X
951	1.2534	0.5445	0.7089	1.52		X
958	2.3434	1.3701	0.9733	2.05	R	
965	2.5114	1.3509	1.1606	2.45	R	
969	2.3117	2.2770	0.0347	0.07		X
982	2.8785	1.4154	1.4631	3.09	R	
984	2.0270	1.0049	1.0222	2.16	R	
994	2.4547	1.3172	1.1375	2.41	R	
995	2.9507	1.5969	1.3538	2.86	R	
998	2.4685	1.4051	1.0634	2.25	R	
1000	2.8466	1.5766	1.2699	2.69	R	
1011	2.8236	1.8590	0.9646	2.04	R	
1059	1.4075	2.3782	-0.9708	-2.04	R	
1096	2.3644	1.3048	1.0596	2.23	R	
1124	2.4184	1.2144	1.2040	2.54	R	
1125	3.0062	1.7801	1.2261	2.58	R	
1126	3.1577	2.1905	0.9672	2.03	R	
1151	0.3164	1.5578	-1.2414	-2.61	R	
1164	2.2865	1.2028	1.0837	2.29	R	
1165	0.2999	1.3220	-1.0221	-2.15	R	
1172	1.4803	0.8102	0.6701	1.42		X
1180	2.7156	1.6710	1.0446	2.21	R	
1193	2.4680	1.4531	1.0149	2.13	R	
1197	2.7851	1.5410	1.2441	2.63	R	
1201	3.0326	2.0260	1.0066	2.13	R	
1204	2.6016	1.6536	0.9480	2.01	R	
1207	2.6113	1.5828	1.0285	2.17	R	

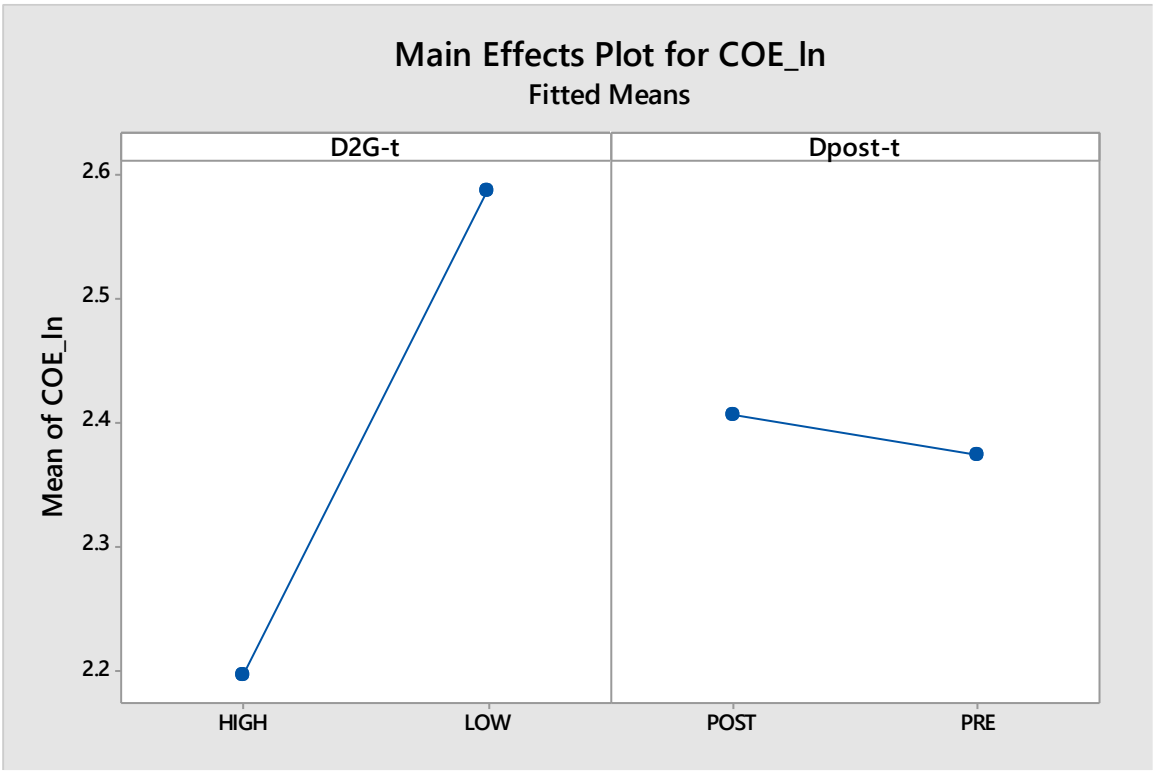
1218	2.6555	1.4998	1.1557	2.44	R	
1236	2.6185	1.5220	1.0965	2.33	R	
1247	3.0419	1.6391	1.4028	2.96	R	
1287	1.5076	2.5511	-1.0435	-2.20	R	
1303	1.2136	2.2127	-0.9991	-2.10	R	
1371	0.3037	1.3287	-1.0250	-2.16	R	
1379	0.7807	2.0857	-1.3049	-2.74	R	
1381	2.3140	1.2646	1.0494	2.22	R	
1417	2.9955	1.9762	1.0193	2.14	R	
1429	0.2345	1.1546	-0.9201	-1.95		X
1432	2.1930	2.3479	-0.1550	-0.33		X
1444	2.3452	1.0159	1.3293	2.80	R	
1456	2.7914	1.2491	1.5423	3.24	R	
1457	2.5365	1.0433	1.4932	3.15	R	
1466	2.3454	1.1039	1.2415	2.62	R	
1468	0.8943	2.1214	-1.2272	-2.59	R	
1482	1.5184	2.6179	-1.0994	-2.32	R	
1532	2.5978	1.3877	1.2101	2.55	R	
1535	2.4582	1.1845	1.2737	2.68	R	
1536	2.9829	1.2878	1.6951	3.57	R	
1549	2.5301	1.4490	1.0811	2.28	R	

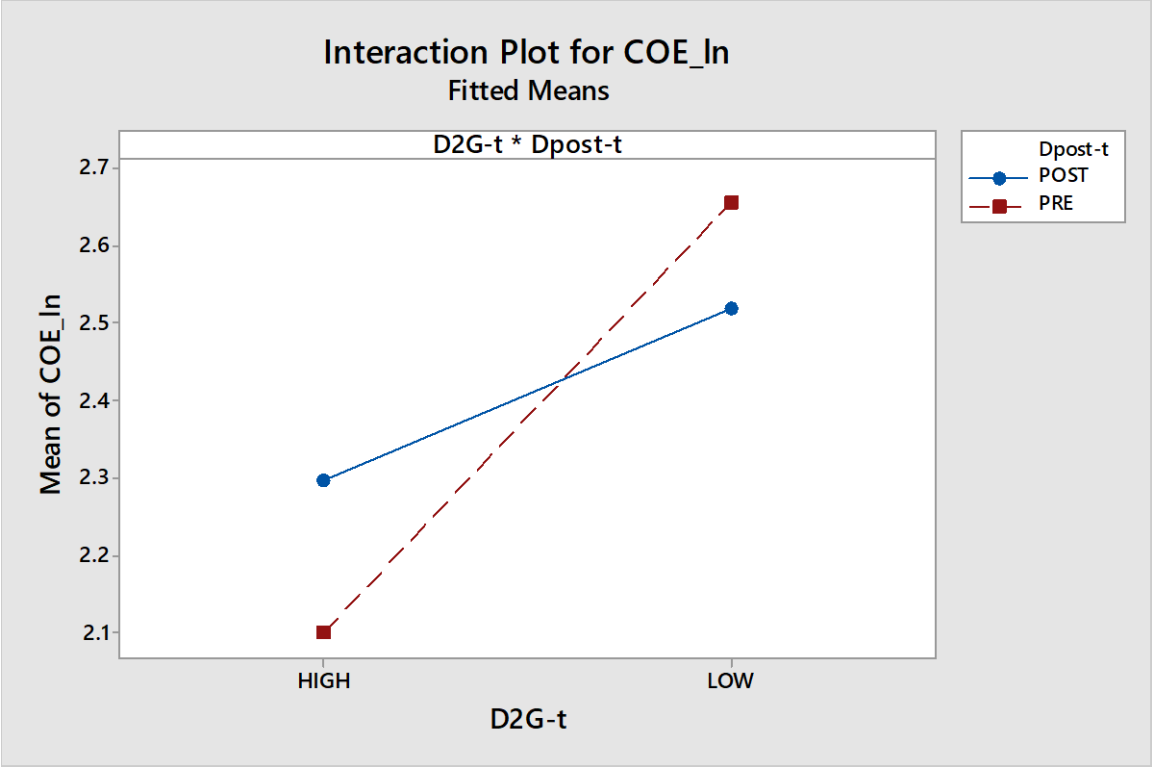
COE_ln' = transformed response
R Large residual
X Unusual X


Residual Plots for COE_ln
Normal Probability Plot
Percent
Residual
Versus Fits
Residual
Fitted Value
Histogram
Frequency
Residual
Versus Order
Residual
Observation Order

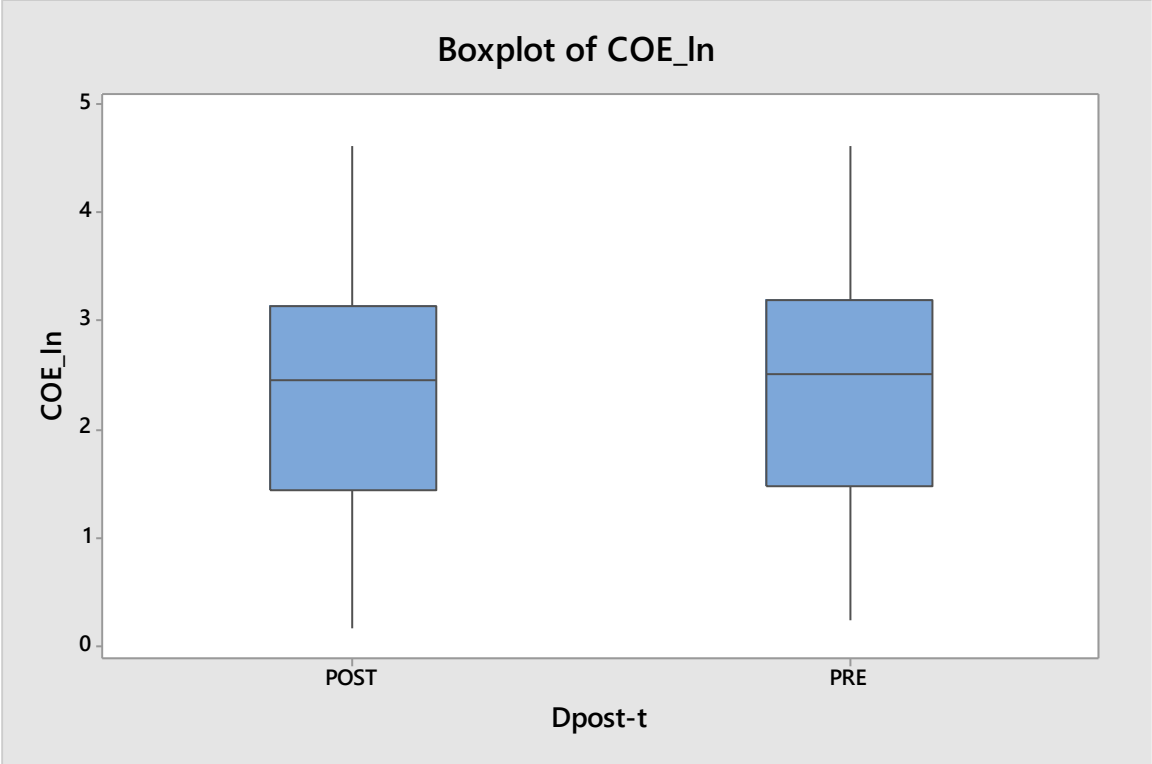

Residuals Versus Dpost
(response is COE_ln)
Residual
Dpost

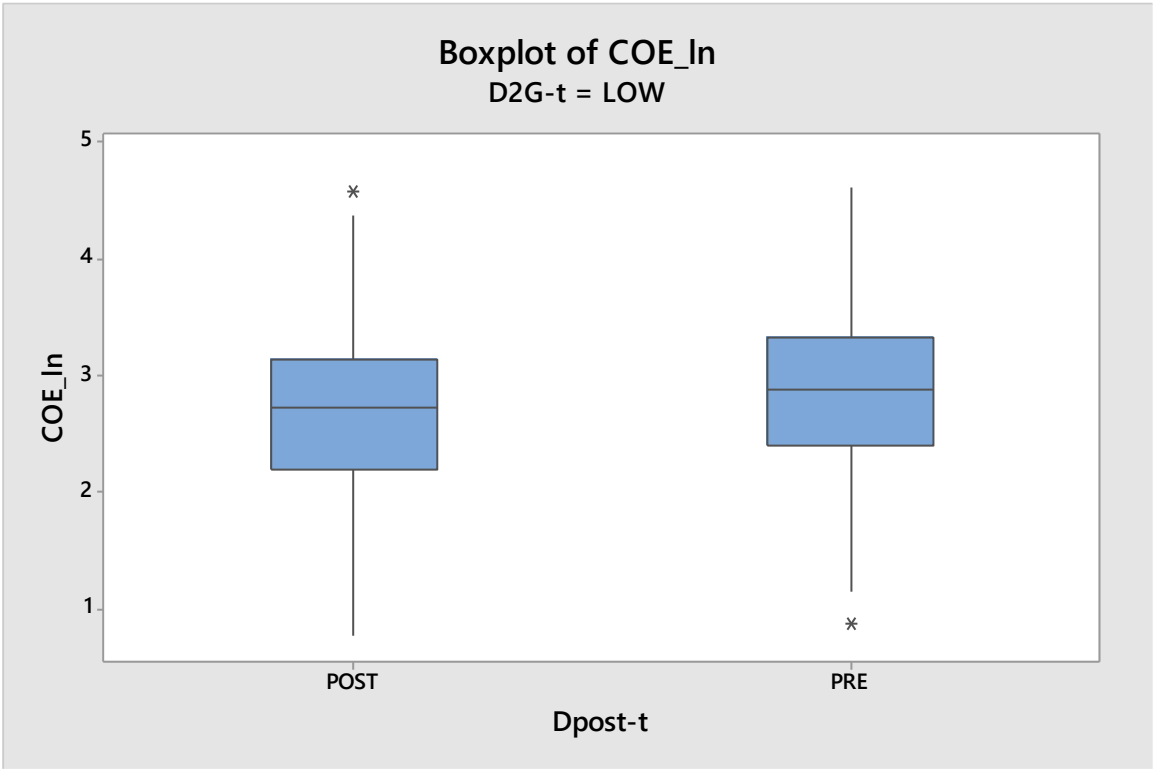

Residuals Versus D2G
(response is COE_ln)
Residual
D2G
3
2
1
0
-1
-2
-3
0.0
0.2
0.4
0.6
0.8
1.0

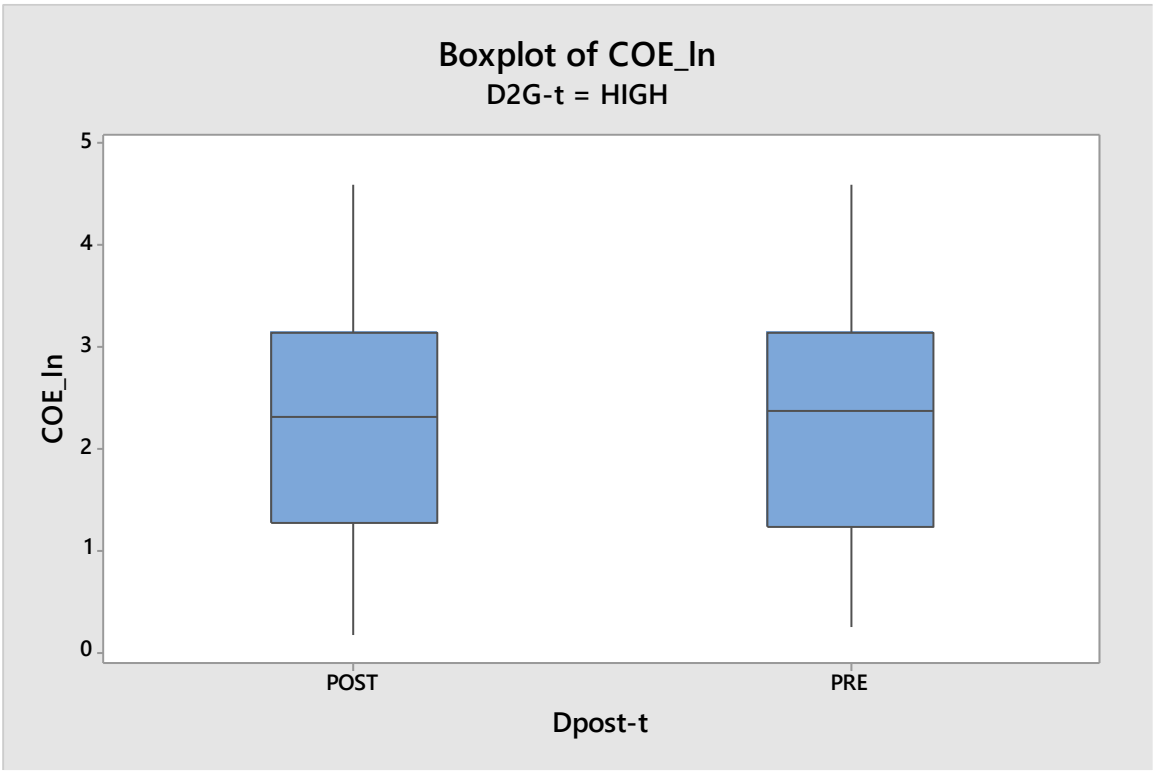

Main Effects Plot for COE_ln
Fitted Means
D2G-t
Dpost-t
Mean of COE_ln
2.6
2.5
2.4
2.3
2.2
HIGH
LOW
POST
PRE

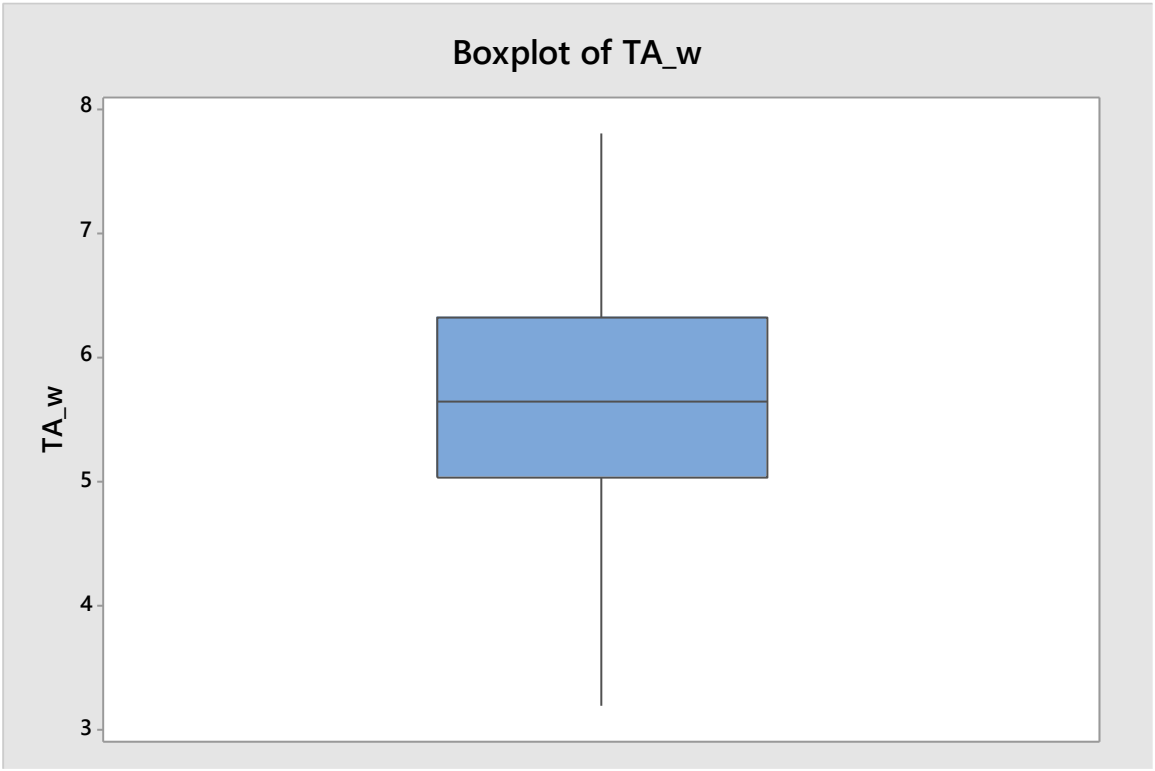

Interaction Plot for COE_ln
Fitted Means
D2G-t * Dpost-t
Mean of COE_ln
2.7
2.6
2.5
2.4
2.3
2.2
2.1
HIGH
LOW
D2G-t
Dpost-t
POST
PRE

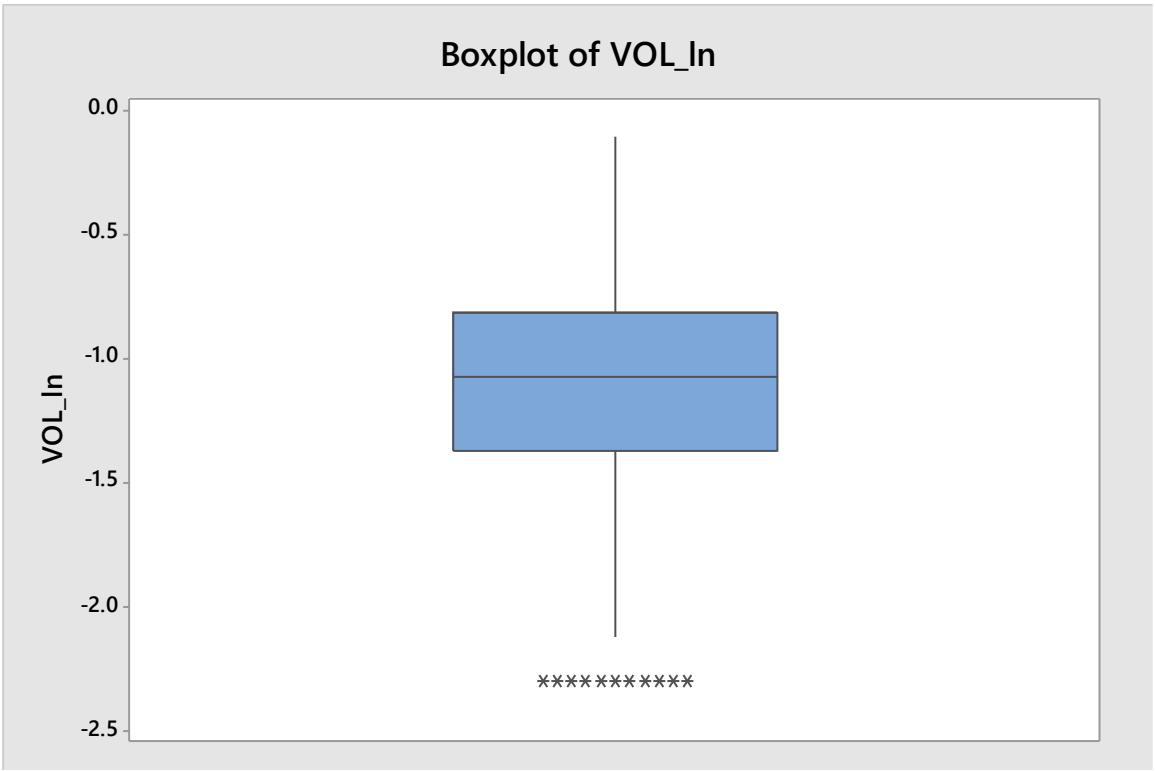
Appendix E: Minitab v18, Statistics

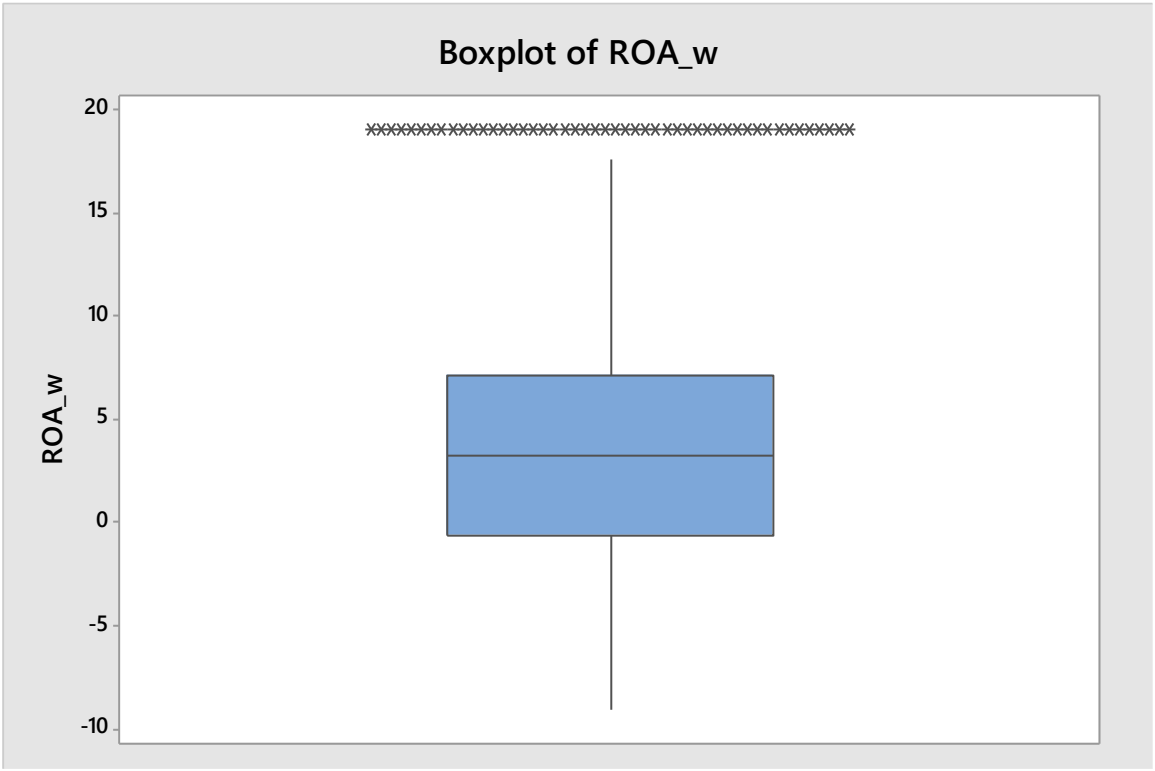


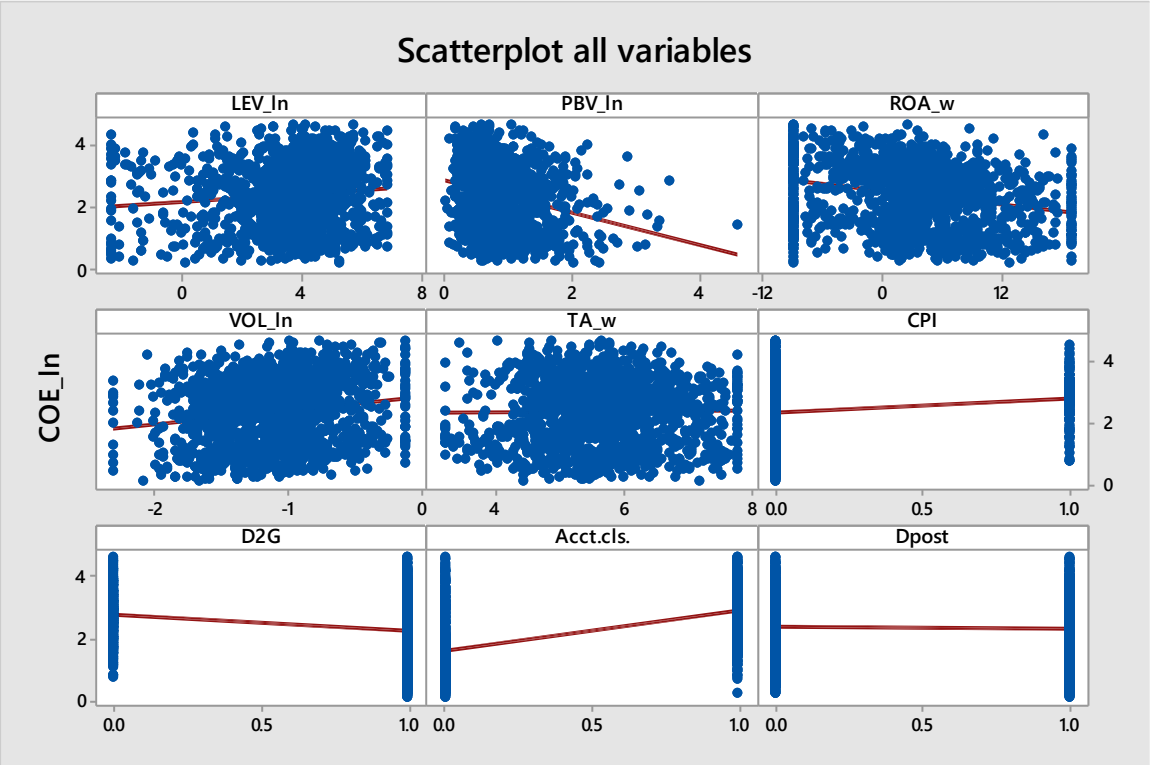

Boxplot of COE_ln
D2G-t = LOW
COE_ln
5
4
3
2
1
POST
PRE
Dpost-t


Boxplot of COE_ln
D2G-t = HIGH
COE_ln
5
4
3
2
1
0
POST
PRE
Dpost-t


Boxplot of TA_w
TA_w
8
7
6
5
4
3


Boxplot of VOL_ln
VOL_ln
0.0
-0.5
-1.0
-1.5
-2.0
-2.5
****


Boxplot of ROA_w
ROA_w
20
15
10
5
0
-5
-10


Scatterplot all variables
LEV_ln
PBV_ln
ROA_w
VOL_ln
TA_w
CPI
D2G
Acct.cls.
Dpost
COE_ln

Appendix F: Minitab v18, robustness checks

Regression Analysis: COE_ln versus LEV_ln, PBV_ln, ROA_w, VOL_ln, TA_w, D2G-t,

Method

Categorical predictor coding	(1, 0)
Rows unused	4

Box-Cox transformation

Rounded λ	0.767643
Estimated λ	0.767643
95% CI for λ	(0.688143, 0.849143)

Analysis of Variance for Transformed Response

Source	DF	Adj SS	Adj MS	F-Value	P-Value
Regression	9	360.464	40.052	175.97	0.000
LEV_ln	1	1.718	1.718	7.55	0.006
PBV_ln	1	9.262	9.262	40.69	0.000
ROA_w	1	18.307	18.307	80.43	0.000
VOL_ln	1	13.013	13.013	57.18	0.000
TA_w	1	0.086	0.086	0.38	0.538
D2G-t	1	1.668	1.668	7.33	0.007
Acct.cls.-t	1	236.385	236.385	1038.57	0.000
Dpost-t	1	3.978	3.978	17.48	0.000
D2G-t*Dpost-t	1	3.452	3.452	15.17	0.000
Error	1537	349.831	0.228		
Total	1546	710.295			

Model Summary for Transformed Response

S	R-sq	R-sq(adj)	R-sq(pred)
0.477081	50.75%	50.46%	50.03%

Coefficients for Transformed Response

Term	Coef	SE Coef	T-Value	P-Value	VIF
Constant	2.6962	0.0829	32.52	0.000	
LEV_ln	0.02110	0.00768	2.75	0.006	1.20

PBV_ln	-0.1732	0.0271	-6.38	0.000	1.22
ROA_w	-0.01847	0.00206	-8.97	0.000	1.43
VOL_ln	0.2551	0.0337	7.56	0.000	1.36
TA_w	-0.0092	0.0150	-0.62	0.538	1.41
D2G-t					
LOW	0.1175	0.0434	2.71	0.007	2.11
Acct.cls.-t					
COMMON	-0.8224	0.0255	-32.23	0.000	1.07
Dpost-t					
PRE	-0.1236	0.0296	-4.18	0.000	1.49
D2G-t*Dpost-t					
LOW PRE	0.2330	0.0598	3.89	0.000	2.33

Regression Equation

D2G-t	Acct.cls.-t	Dpost-t	
HIGH	CODE	POST	COE_ln^0.767643 = 2.6962 + 0.02110 LEV_ln - 0.1732 PBV_ln - 0.01847 ROA_w + 0.2551 VOL_ln - 0.0092 TA_w
HIGH	CODE	PRE	COE_ln^0.767643 = 2.5726 + 0.02110 LEV_ln - 0.1732 PBV_ln - 0.01847 ROA_w + 0.2551 VOL_ln - 0.0092 TA_w
HIGH	COMMON	POST	COE_ln^0.767643 = 1.8738 + 0.02110 LEV_ln - 0.1732 PBV_ln - 0.01847 ROA_w + 0.2551 VOL_ln - 0.0092 TA_w
HIGH	COMMON	PRE	COE_ln^0.767643 = 1.7502 + 0.02110 LEV_ln - 0.1732 PBV_ln - 0.01847 ROA_w + 0.2551 VOL_ln - 0.0092 TA_w
LOW	CODE	POST	COE_ln^0.767643 = 2.8136 + 0.02110 LEV_ln - 0.1732 PBV_ln - 0.01847 ROA_w + 0.2551 VOL_ln - 0.0092 TA_w

LOW CODE PRE COE_ln^0.767643 = 2.9230 + 0.02110 LEV_ln
- 0.1732 PBV_ln
- 0.01847 ROA_w + 0.2551 VOL_ln
- 0.0092 TA_w

LOW COMMON POST COE_ln^0.767643 = 1.9913 + 0.02110 LEV_ln
- 0.1732 PBV_ln
- 0.01847 ROA_w + 0.2551 VOL_ln
- 0.0092 TA_w

LOW COMMON PRE COE_ln^0.767643 = 2.1006 + 0.02110 LEV_ln
- 0.1732 PBV_ln
- 0.01847 ROA_w + 0.2551 VOL_ln
- 0.0092 TA_w

Fits and Diagnostics for Unusual Observations

Original Response

Obs	COE_ln	Fit
15	2.9030	1.8722
21	3.6661	1.8476
55	4.5799	2.5219
129	1.5739	3.1634
145	3.1076	1.4115
169	4.1518	2.2656
184	3.9406	3.0583
213	4.0541	2.3403
229	2.2430	3.2497
246	1.4839	3.0140
247	0.3196	1.6718
260	2.4818	3.0941
262	1.1495	3.5896
283	3.8226	2.1960
288	0.8705	2.8895
294	0.5248	1.9234
296	4.1683	2.0312
306	1.3124	2.7837
309	0.2766	2.6831
345	0.8084	2.2482
356	3.6701	1.7280
426	3.0373	1.3301

453	3.3739	1.2650
474	0.4573	2.0620
481	4.2066	2.0218
540	3.5902	1.4990
542	1.8957	1.5853
554	4.5241	2.0142
564	0.3415	1.7432
609	3.9030	1.6575
626	1.0554	3.4429
633	3.4720	1.6461
638	3.9962	1.7697
640	1.2694	2.7746
645	3.5501	1.6235
678	0.4736	1.7508
697	3.2373	1.6382
751	3.1972	1.6477
752	1.5284	3.2211
779	2.6475	2.9453
806	3.7800	1.2640
809	3.2663	1.4769
814	0.5878	1.9585
821	1.0439	2.5208
869	4.4452	1.5766
874	3.9151	2.0190
887	4.3479	2.1391
891	3.7383	2.0533
894	1.3290	0.7426
896	1.1977	2.7728
905	3.8357	2.0624
911	3.5759	1.8316
933	4.6028	2.1726
934	0.7529	3.2072
940	1.4961	1.4752
951	1.3424	0.4494
958	3.0357	1.5062
965	3.3225	1.4774
978	0.7115	2.0348
982	3.9693	1.6546
984	2.5126	1.0810
994	3.2249	1.5111
995	4.0997	1.9253
998	3.2487	1.6390
1000	3.9120	1.8948

1011	3.8709	2.2419
1059	1.5615	3.0908
1096	3.0711	1.4177
1124	3.1630	1.2902
1125	4.2004	2.1159
1126	4.4785	2.7767
1151	0.2230	1.7857
1164	2.9399	1.2415
1165	0.2080	1.4412
1172	1.6677	0.7590
1180	3.6789	1.9187
1193	3.2477	1.6312
1197	3.8022	1.7539
1201	4.2487	2.4746
1204	3.4789	1.8923
1207	3.4958	1.7885
1218	3.5731	1.6991
1236	3.5084	1.8149
1247	4.2655	1.8718
1287	1.7079	3.4469
1303	1.2871	2.8150
1371	0.2114	1.4513
1379	0.7242	2.6049
1381	2.9861	1.4396
1417	4.1810	2.4287
1429	0.1509	1.2097
1432	2.7841	3.0011
1444	3.0387	1.0231
1456	3.8135	1.3399
1457	3.3657	1.0589
1466	3.0390	1.1420
1468	0.8644	2.6597
1482	1.7239	3.4615
1529	0.6421	0.6520
1532	3.4722	1.5300
1535	3.2309	1.2495
1536	4.1580	1.3943
1549	3.3548	1.6257

Transformed Response

Obs	COE_ln'	Fit	Resid	Std Resid

15	2.2662	1.6183	0.6478	1.37		X
21	2.7109	1.6020	1.1089	2.34	R	
55	3.2159	2.0342	1.1817	2.50	R	
129	1.4165	2.4207	-1.0042	-2.12	R	
145	2.3878	1.3028	1.0850	2.30	R	
169	2.9825	1.8735	1.1090	2.33	R	
184	2.8654	2.3587	0.5066	1.07		X
213	2.9285	1.9207	1.0078	2.12	R	
229	1.8591	2.4712	-0.6121	-1.30		X
246	1.3539	2.3324	-0.9786	-2.06	R	
247	0.4166	1.4836	-1.0670	-2.24	R	
260	2.0093	2.3799	-0.3706	-0.79		X
262	1.1129	2.6674	-1.5545	-3.27	R	
283	2.7992	1.8292	0.9701	2.04	R	
288	0.8990	2.2581	-1.3591	-2.87	R	
294	0.6096	1.6522	-1.0426	-2.19	R	
296	2.9916	1.7228	1.2688	2.67	R	
306	1.2320	2.1944	-0.9623	-2.02	R	
309	0.3729	2.1333	-1.7604	-3.70	R	
345	0.8494	1.8624	-1.0131	-2.13	R	
356	2.7131	1.5217	1.1914	2.50	R	
426	2.3462	1.2448	1.1014	2.32	R	
453	2.5434	1.1978	1.3456	2.84	R	
474	0.5485	1.7429	-1.1944	-2.51	R	
481	3.0127	1.7167	1.2960	2.73	R	
540	2.6677	1.3644	1.3033	2.77	R	X
542	1.6339	1.4243	0.2095	0.44		X
554	3.1858	1.7117	1.4740	3.10	R	
564	0.4384	1.5320	-1.0936	-2.30	R	
609	2.8444	1.4739	1.3705	2.88	R	
626	1.0423	2.5833	-1.5410	-3.24	R	
633	2.6000	1.4661	1.1339	2.39	R	
638	2.8963	1.5499	1.3465	2.84	R	
640	1.2009	2.1889	-0.9879	-2.07	R	
645	2.6448	1.4506	1.1941	2.52	R	
678	0.5634	1.5371	-0.9737	-2.05	R	
697	2.4640	1.4607	1.0033	2.12	R	
751	2.4405	1.4672	0.9733	2.05	R	
752	1.3849	2.4545	-1.0696	-2.25	R	
779	2.1115	2.2915	-0.1801	-0.38		X
806	2.7753	1.1970	1.5783	3.32	R	
809	2.4809	1.3490	1.1320	2.38	R	
814	0.6650	1.6753	-1.0103	-2.12	R	

821	1.0336	2.0335	-0.9999	-2.11	R	
869	3.1430	1.4184	1.7247	3.62	R	
874	2.8511	1.7149	1.1362	2.39	R	
887	3.0901	1.7926	1.2974	2.73	R	
891	2.7518	1.7372	1.0146	2.14	R	
894	1.2440	0.7958	0.4482	0.95		X
896	1.1486	2.1878	-1.0392	-2.19	R	
905	2.8066	1.7431	1.0636	2.24	R	
911	2.6595	1.5913	1.0682	2.25	R	
933	3.2282	1.8142	1.4141	2.97	R	
934	0.8042	2.4464	-1.6422	-3.45	R	
940	1.3624	1.3478	0.0146	0.03		X
951	1.2537	0.5411	0.7125	1.53		X
958	2.3453	1.3695	0.9758	2.05	R	
965	2.5136	1.3494	1.1643	2.45	R	
978	0.7700	1.7252	-0.9551	-2.01	R	
982	2.8814	1.4719	1.4094	2.96	R	
984	2.0284	1.0616	0.9668	2.03	R	
994	2.4568	1.3729	1.0839	2.28	R	
995	2.9537	1.6534	1.3003	2.73	R	
998	2.4706	1.4612	1.0094	2.12	R	
1000	2.8494	1.6333	1.2160	2.56	R	
1011	2.8264	1.8584	0.9680	2.04	R	
1059	1.4079	2.3780	-0.9700	-2.04	R	
1096	2.3663	1.3073	1.0590	2.22	R	
1124	2.4204	1.2161	1.2044	2.54	R	
1125	3.0093	1.7777	1.2316	2.59	R	
1126	3.1611	2.1901	0.9710	2.04	R	
1151	0.3160	1.5606	-1.2446	-2.62	R	
1164	2.2883	1.1806	1.1077	2.34	R	
1165	0.2996	1.3239	-1.0243	-2.15	R	
1172	1.4808	0.8092	0.6716	1.42		X
1180	2.7182	1.6491	1.0690	2.26	R	
1193	2.4701	1.4559	1.0142	2.13	R	
1197	2.7878	1.5392	1.2486	2.63	R	
1201	3.0358	2.0048	1.0310	2.17	R	
1204	2.6040	1.6317	0.9723	2.05	R	
1207	2.6137	1.5625	1.0512	2.22	R	
1218	2.6579	1.5022	1.1557	2.43	R	
1236	2.6209	1.5802	1.0407	2.19	R	
1247	3.0450	1.6180	1.4270	3.01	R	
1287	1.5082	2.5855	-1.0774	-2.27	R	
1303	1.2138	2.2133	-0.9995	-2.10	R	

1371	0.3033	1.3310	-1.0277	-2.16	R	
1379	0.7806	2.0853	-1.3048	-2.74	R	
1381	2.3158	1.3227	0.9931	2.09	R	
1417	2.9986	1.9762	1.0224	2.15	R	
1429	0.2342	1.1574	-0.9232	-1.96		X
1432	2.1946	2.3248	-0.1302	-0.28		X
1444	2.3471	1.0177	1.3294	2.79	R	
1456	2.7941	1.2519	1.5423	3.24	R	
1457	2.5387	1.0449	1.4938	3.14	R	
1466	2.3473	1.1073	1.2399	2.61	R	
1468	0.8942	2.1189	-1.2247	-2.58	R	
1482	1.5190	2.5939	-1.0749	-2.26	R	
1529	0.7117	0.7201	-0.0084	-0.02		X
1532	2.6001	1.3861	1.2140	2.55	R	
1535	2.4602	1.1865	1.2737	2.68	R	
1536	2.9860	1.2906	1.6953	3.57	R	
1549	2.5323	1.4521	1.0802	2.28	R	

COE_ln' = transformed response
R Large residual
X Unusual X

Regression Analysis: COE_ln versus LEV_ln, PBV_ln, ROA_w, VOL_ln, D2G-t, Acct.cls.-t, Dpost-t

Method

Categorical predictor coding	(1, 0)
Rows unused	4

Box-Cox transformation

Rounded λ	0.768133
Estimated λ	0.768133
95% CI for λ	(0.688633, 0.849633)

Analysis of Variance for Transformed Response

Source	DF	Adj SS	Adj MS	F-Value	P-Value
Regression	8	361.060	45.132	197.98	0.000
LEV_ln	1	1.682	1.682	7.38	0.007
PBV_ln	1	9.194	9.194	40.33	0.000
ROA_w	1	19.875	19.875	87.18	0.000
VOL_ln	1	14.989	14.989	65.75	0.000
D2G-t	1	1.662	1.662	7.29	0.007
Acct.cls.-t	1	240.059	240.059	1053.05	0.000
Dpost-t	1	4.246	4.246	18.63	0.000
D2G-t*Dpost-t	1	3.457	3.457	15.16	0.000
Error	1538	350.610	0.228		
Total	1546	711.669			

Model Summary for Transformed Response

S	R-sq	R-sq(adj)	R-sq(pred)
0.477456	50.73%	50.48%	50.08%

Coefficients for Transformed Response

Term	Coef	SE Coef	T-Value	P-Value	VIF
Constant	2.6585	0.0531	50.08	0.000	
LEV_ln	0.01933	0.00712	2.72	0.007	1.03
PBV_ln	-0.1718	0.0271	-6.35	0.000	1.21

ROA_w	-0.01877	0.00201	-9.34	0.000	1.36
VOL_ln	0.2615	0.0322	8.11	0.000	1.24
D2G-t					
LOW	0.1173	0.0434	2.70	0.007	2.11
Acct.cls.-t					
COMMON	-0.8210	0.0253	-32.45	0.000	1.05
Dpost-t					
PRE	-0.1263	0.0293	-4.32	0.000	1.45
D2G-t*Dpost-t					
LOW PRE	0.2331	0.0599	3.89	0.000	2.33

Regression Equation

D2G-t	Acct.cls.-t	Dpost-t	
HIGH	CODE	POST	COE_ln^0.768133 = 2.6585 + 0.01933 LEV_ln - 0.1718 PBV_ln - 0.01877 ROA_w + 0.2615 VOL_ln
HIGH	CODE	PRE	COE_ln^0.768133 = 2.5322 + 0.01933 LEV_ln - 0.1718 PBV_ln - 0.01877 ROA_w + 0.2615 VOL_ln
HIGH	COMMON	POST	COE_ln^0.768133 = 1.8375 + 0.01933 LEV_ln - 0.1718 PBV_ln - 0.01877 ROA_w + 0.2615 VOL_ln
HIGH	COMMON	PRE	COE_ln^0.768133 = 1.7112 + 0.01933 LEV_ln - 0.1718 PBV_ln - 0.01877 ROA_w + 0.2615 VOL_ln
LOW	CODE	POST	COE_ln^0.768133 = 2.7758 + 0.01933 LEV_ln - 0.1718 PBV_ln - 0.01877 ROA_w + 0.2615 VOL_ln
LOW	CODE	PRE	COE_ln^0.768133 = 2.8826 + 0.01933 LEV_ln - 0.1718 PBV_ln - 0.01877 ROA_w + 0.2615 VOL_ln
LOW	COMMON	POST	COE_ln^0.768133 = 1.9548 + 0.01933 LEV_ln - 0.1718 PBV_ln - 0.01877 ROA_w + 0.2615 VOL_ln

LOW COMMON PRE COE_ln^0.768133 = 2.0616 + 0.01933 LEV_ln
- 0.1718 PBV_ln
- 0.01877 ROA_w + 0.2615 VOL_ln

Fits and Diagnostics for Unusual Observations

Original Response

Obs	COE_ln	Fit
15	2.9030	1.8762
21	3.6661	1.8530
55	4.5799	2.5431
113	3.8797	3.3802
123	3.9745	3.1294
129	1.5739	3.1691
145	3.1076	1.4166
169	4.1518	2.2683
184	3.9406	3.0808
213	4.0541	2.3271
229	2.2430	3.2435
236	1.8142	0.9863
246	1.4839	2.9969
247	0.3196	1.6739
260	2.4818	3.0897
262	1.1495	3.5952
283	3.8226	2.1953
288	0.8705	2.8945
294	0.5248	1.9117
296	4.1683	2.0281
309	0.2766	2.6941
345	0.8084	2.2592
356	3.6701	1.7093
426	3.0373	1.3258
453	3.3739	1.2668
474	0.4573	2.0682
481	4.2066	2.0018
540	3.5902	1.4837
554	4.5241	1.9940
564	0.3415	1.7419
609	3.9030	1.6643
626	1.0554	3.4254
633	3.4720	1.6791

638	3.9962	1.7661
640	1.2694	2.7868
645	3.5501	1.6389
678	0.4736	1.7576
697	3.2373	1.6625
751	3.1972	1.6506
752	1.5284	3.2053
779	2.6475	2.9445
794	0.7331	0.7939
806	3.7800	1.2778
809	3.2663	1.4789
814	0.5878	1.9769
821	1.0439	2.5086
869	4.4452	1.5731
874	3.9151	1.9973
887	4.3479	2.1451
891	3.7383	2.0552
894	1.3290	0.7450
896	1.1977	2.7792
905	3.8357	2.0586
911	3.5759	1.8330
933	4.6028	2.1618
934	0.7529	3.1980
940	1.4961	1.4615
951	1.3424	0.4283
958	3.0357	1.5136
965	3.3225	1.4728
978	0.7115	2.0304
982	3.9693	1.6629
984	2.5126	1.0866
994	3.2249	1.5186
995	4.0997	1.9339
998	3.2487	1.6418
1000	3.9120	1.9164
1011	3.8709	2.2407
1059	1.5615	3.0810
1096	3.0711	1.4208
1124	3.1630	1.2635
1125	4.2004	2.1252
1126	4.4785	2.7699
1151	0.2230	1.7912
1164	2.9399	1.2203
1165	0.2080	1.4326

1172	1.6677	0.7534
1180	3.6789	1.8975
1193	3.2477	1.6361
1197	3.8022	1.7379
1201	4.2487	2.4736
1204	3.4789	1.8853
1207	3.4958	1.8052
1218	3.5731	1.6952
1236	3.5084	1.8259
1247	4.2655	1.8707
1287	1.7079	3.4359
1303	1.2871	2.8268
1371	0.2114	1.4507
1379	0.7242	2.5934
1381	2.9861	1.4469
1417	4.1810	2.4299
1429	0.1509	1.2092
1432	2.7841	2.9928
1444	3.0387	1.0102
1456	3.8135	1.3444
1457	3.3657	1.0422
1466	3.0390	1.1660
1468	0.8644	2.6715
1482	1.7239	3.4575
1529	0.6421	0.6415
1532	3.4722	1.5460
1535	3.2309	1.2308
1536	4.1580	1.3929
1549	3.3548	1.6217

Transformed Response

Obs	COE_ln'	Fit	Resid	Std Resid		
15	2.2674	1.6215	0.6459	1.37		X
21	2.7126	1.6061	1.1065	2.33	R	
55	3.2183	2.0482	1.1701	2.47	R	
113	2.8332	2.5486	0.2846	0.60		X
123	2.8862	2.4020	0.4842	1.02		X
129	1.4168	2.4254	-1.0086	-2.13	R	
145	2.3892	1.3067	1.0824	2.29	R	X
169	2.9846	1.8760	1.1086	2.33	R	
184	2.8673	2.3733	0.4940	1.04		X

213	2.9305	1.9132	1.0173	2.14	R	
229	1.8599	2.4690	-0.6092	-1.29		X
236	1.5802	0.9895	0.5907	1.25		X
246	1.3541	2.3235	-0.9694	-2.04	R	
247	0.4164	1.4854	-1.0691	-2.24	R	
260	2.0102	2.3786	-0.3684	-0.78		X
262	1.1130	2.6722	-1.5592	-3.28	R	
283	2.8011	1.8294	0.9717	2.05	R	
288	0.8989	2.2623	-1.3633	-2.87	R	
294	0.6094	1.6450	-1.0356	-2.17	R	
296	2.9937	1.7214	1.2723	2.68	R	
309	0.3727	2.1410	-1.7683	-3.71	R	
345	0.8493	1.8702	-1.0209	-2.15	R	
356	2.7148	1.5095	1.2053	2.53	R	
426	2.3475	1.2419	1.1056	2.33	R	
453	2.5449	1.1992	1.3457	2.84	R	
474	0.5483	1.7475	-1.1992	-2.52	R	
481	3.0149	1.7042	1.3106	2.75	R	
540	2.6694	1.3540	1.3154	2.79	R	X
554	3.1881	1.6992	1.4890	3.13	R	
564	0.4381	1.5316	-1.0934	-2.30	R	
609	2.8463	1.4789	1.3674	2.87	R	
626	1.0423	2.5747	-1.5324	-3.22	R	
633	2.6016	1.4890	1.1126	2.33	R	
638	2.8983	1.5479	1.3504	2.84	R	
640	1.2011	2.1973	-0.9963	-2.09	R	
645	2.6464	1.4615	1.1849	2.49	R	
678	0.5632	1.5422	-0.9790	-2.06	R	
697	2.4654	1.4776	0.9878	2.08	R	
751	2.4419	1.4695	0.9724	2.04	R	
752	1.3852	2.4467	-1.0614	-2.23	R	
779	2.1125	2.2923	-0.1798	-0.38		X
794	0.7879	0.8376	-0.0497	-0.11		X
806	2.7771	1.2072	1.5699	3.29	R	
809	2.4824	1.3506	1.1318	2.37	R	
814	0.6649	1.6879	-1.0231	-2.15	R	
821	1.0336	2.0268	-0.9933	-2.09	R	
869	3.1454	1.4162	1.7291	3.63	R	
874	2.8530	1.7013	1.1517	2.42	R	
887	3.0923	1.7972	1.2951	2.72	R	
891	2.7536	1.7390	1.0145	2.14	R	
894	1.2441	0.7977	0.4465	0.94		X
896	1.1487	2.1928	-1.0441	-2.19	R	

905	2.8085	1.7413	1.0672	2.24	R	
911	2.6612	1.5927	1.0685	2.24	R	
933	3.2306	1.8079	1.4227	2.99	R	
934	0.8041	2.4424	-1.6383	-3.44	R	
940	1.3627	1.3384	0.0243	0.05		X
951	1.2538	0.5214	0.7325	1.57		X
958	2.3466	1.3749	0.9717	2.04	R	
965	2.5151	1.3464	1.1687	2.46	R	
978	0.7699	1.7229	-0.9530	-2.00	R	
982	2.8833	1.4780	1.4054	2.95	R	
984	2.0293	1.0659	0.9634	2.02	R	
994	2.4582	1.3784	1.0798	2.27	R	
995	2.9558	1.6597	1.2961	2.72	R	
998	2.4721	1.4635	1.0085	2.12	R	
1000	2.8513	1.6481	1.2032	2.53	R	
1011	2.8283	1.8584	0.9699	2.04	R	
1059	1.4082	2.3735	-0.9652	-2.02	R	
1096	2.3676	1.3097	1.0579	2.22	R	
1124	2.4218	1.1968	1.2250	2.58	R	
1125	3.0114	1.7844	1.2270	2.58	R	
1126	3.1634	2.1871	0.9763	2.05	R	
1151	0.3158	1.5648	-1.2490	-2.62	R	
1164	2.2895	1.1652	1.1243	2.37	R	
1165	0.2993	1.3180	-1.0187	-2.14	R	
1172	1.4812	0.8045	0.6767	1.43		X
1180	2.7199	1.6356	1.0842	2.28	R	
1193	2.4715	1.4596	1.0119	2.12	R	
1197	2.7896	1.5289	1.2608	2.65	R	
1201	3.0380	2.0051	1.0329	2.17	R	
1204	2.6056	1.6275	0.9780	2.06	R	
1207	2.6153	1.5741	1.0411	2.19	R	
1218	2.6596	1.5000	1.1596	2.44	R	
1236	2.6225	1.5880	1.0345	2.18	R	
1247	3.0472	1.6179	1.4293	3.01	R	
1287	1.5086	2.5808	-1.0722	-2.25	R	
1303	1.2139	2.2215	-1.0076	-2.11	R	
1371	0.3031	1.3308	-1.0277	-2.16	R	
1379	0.7804	2.0793	-1.2988	-2.72	R	
1381	2.3171	1.3282	0.9889	2.08	R	
1417	3.0007	1.9778	1.0229	2.15	R	
1429	0.2340	1.1571	-0.9231	-1.96		X
1432	2.1957	2.3211	-0.1254	-0.27		X
1444	2.3484	1.0078	1.3406	2.81	R	

1456	2.7960	1.2552	1.5408	3.23	R	
1457	2.5402	1.0323	1.5079	3.17	R	
1466	2.3485	1.1252	1.2233	2.57	R	
1468	0.8941	2.1272	-1.2331	-2.59	R	
1482	1.5194	2.5932	-1.0738	-2.26	R	
1529	0.7116	0.7111	0.0005	0.00		X
1532	2.6017	1.3975	1.2042	2.53	R	
1535	2.4617	1.1729	1.2887	2.71	R	
1536	2.9880	1.2899	1.6982	3.57	R	
1549	2.5338	1.4497	1.0841	2.29	R	

COE_ln' = transformed response
R Large residual
X Unusual X

Regression Analysis: COE_ln versus LEV_ln, PBV_ln, TA_w, CPI-t, D2G-t, Acct.cls.-t, Dpost-t

Method

Categorical predictor coding	(1, 0)
Rows unused	4

Box-Cox transformation

Rounded λ	0.751447
Estimated λ	0.751447
95% CI for λ	(0.671947, 0.832947)

Analysis of Variance for Transformed Response

Source	DF	Adj SS	Adj MS	F-Value	P-Value
Regression	8	302.326	37.791	159.76	0.000
LEV_ln	1	6.849	6.849	28.95	0.000
PBV_ln	1	29.360	29.360	124.12	0.000
TA_w	1	9.074	9.074	38.36	0.000
CPI-t	1	0.287	0.287	1.21	0.271
D2G-t	1	2.078	2.078	8.79	0.003
Acct.cls.-t	1	213.049	213.049	900.66	0.000
Dpost-t	1	0.123	0.123	0.52	0.471
D2G-t*Dpost-t	1	2.963	2.963	12.53	0.000
Error	1538	363.809	0.237		
Total	1546	666.135			

Model Summary for Transformed Response

S	R-sq	R-sq(adj)	R-sq(pred)
0.486361	45.39%	45.10%	44.64%

Coefficients for Transformed Response

Term	Coef	SE Coef	T-Value	P-Value	VIF
Constant	2.6621	0.0926	28.74	0.000	
LEV_ln	0.04098	0.00762	5.38	0.000	1.14
PBV_ln	-0.2848	0.0256	-11.14	0.000	1.04

TA_w	-0.0864	0.0140	-6.19	0.000	1.17
CPI-t					
LOW	0.0542	0.0492	1.10	0.271	1.25
D2G-t					
LOW	0.1306	0.0441	2.96	0.003	2.10
Acct.cls.-t					
COMMON	-0.7850	0.0262	-30.01	0.000	1.09
Dpost-t					
PRE	0.0204	0.0283	0.72	0.471	1.31
D2G-t*Dpost-t					
LOW PRE	0.2205	0.0623	3.54	0.000	2.43

Regression Equation

CPI-t	D2G-t	Acct.cls.-t	Dpost-t	
HIGH	HIGH	CODE	POST	COE_ln^0.751447 = 2.6621 + 0.04098 LEV_ln - 0.2848 PBV_ln - 0.0864 TA_w
HIGH	HIGH	CODE	PRE	COE_ln^0.751447 = 2.6825 + 0.04098 LEV_ln - 0.2848 PBV_ln - 0.0864 TA_w
HIGH	HIGH	COMMON	POST	COE_ln^0.751447 = 1.8770 + 0.04098 LEV_ln - 0.2848 PBV_ln - 0.0864 TA_w
HIGH	HIGH	COMMON	PRE	COE_ln^0.751447 = 1.8974 + 0.04098 LEV_ln - 0.2848 PBV_ln - 0.0864 TA_w
HIGH	LOW	CODE	POST	COE_ln^0.751447 = 2.7927 + 0.04098 LEV_ln - 0.2848 PBV_ln - 0.0864 TA_w
HIGH	LOW	CODE	PRE	COE_ln^0.751447 = 3.0336 + 0.04098 LEV_ln - 0.2848 PBV_ln - 0.0864 TA_w
HIGH	LOW	COMMON	POST	COE_ln^0.751447 = 2.0077 + 0.04098 LEV_ln - 0.2848 PBV_ln - 0.0864 TA_w

HIGH LOW COMMON PRE COE_ln^0.751447 = 2.2486 + 0.04098 LEV_ln - 0.2848 PBV_ln
- 0.0864 TA_w

LOW HIGH CODE POST COE_ln^0.751447 = 2.7162 + 0.04098 LEV_ln - 0.2848 PBV_ln
- 0.0864 TA_w

LOW HIGH CODE PRE COE_ln^0.751447 = 2.7366 + 0.04098 LEV_ln - 0.2848 PBV_ln
- 0.0864 TA_w

LOW HIGH COMMON POST COE_ln^0.751447 = 1.9312 + 0.04098 LEV_ln - 0.2848 PBV_ln
- 0.0864 TA_w

LOW HIGH COMMON PRE COE_ln^0.751447 = 1.9516 + 0.04098 LEV_ln - 0.2848 PBV_ln
- 0.0864 TA_w

LOW LOW CODE POST COE_ln^0.751447 = 2.8468 + 0.04098 LEV_ln - 0.2848 PBV_ln
- 0.0864 TA_w

LOW LOW CODE PRE COE_ln^0.751447 = 3.0878 + 0.04098 LEV_ln - 0.2848 PBV_ln
- 0.0864 TA_w

LOW LOW COMMON POST COE_ln^0.751447 = 2.0618 + 0.04098 LEV_ln - 0.2848 PBV_ln
- 0.0864 TA_w

LOW LOW COMMON PRE COE_ln^0.751447 = 2.3027 + 0.04098 LEV_ln - 0.2848 PBV_ln
- 0.0864 TA_w

Fits and Diagnostics for Unusual Observations

Original Response

Obs	COE_ln	Fit

11	1.3709	1.6096
15	2.9030	1.0210
19	3.3270	1.3130
21	3.6661	1.5322
46	1.8713	2.1175
55	4.5799	1.8477
116	1.5282	1.7619
143	1.6892	1.8363
145	3.1076	1.4181
155	1.1519	2.8317
169	4.1518	1.8216
184	3.9406	2.1004
189	4.3166	2.3054
207	3.8811	2.0906
236	1.8142	1.2426
247	0.3196	1.6015
260	2.4818	2.4092
262	1.1495	3.4512
283	3.8226	1.8064
288	0.8705	2.7859
294	0.5248	1.8884
296	4.1683	2.0106
309	0.2766	2.7493
356	3.6701	1.8159
375	2.9684	1.3195
426	3.0373	1.3742
431	4.4447	2.6271
453	3.3739	1.3461
474	0.4573	1.8194
481	4.2066	1.7855
540	3.5902	0.9815
542	1.8957	1.2506
554	4.5241	1.8176
564	0.3415	1.6629
609	3.9030	1.5414
626	1.0554	3.2157
633	3.4720	1.3163
638	3.9962	1.9964
645	3.5501	1.4541
751	3.1972	1.5705
761	0.4131	1.7685
779	2.6475	2.2294
794	0.7331	0.8218

806	3.7800	1.1731
809	3.2663	1.5715
821	1.0439	3.0406
869	4.4452	1.6024
870	1.2783	1.6514
874	3.9151	1.7470
876	3.5463	1.7035
887	4.3479	1.6732
894	1.3290	0.6504
896	1.1977	2.7160
905	3.8357	1.6087
911	3.5759	1.5744
917	2.9304	1.6216
929	3.6895	1.8868
933	4.6028	1.8189
934	0.7529	2.7857
938	3.1967	1.3321
940	1.4961	0.8126
951	1.3424	0.4568
965	3.3225	1.5781
969	2.9822	2.2505
977	3.3540	1.7288
982	3.9693	1.4448
994	3.2249	1.3175
995	4.0997	1.5162
998	3.2487	1.5953
1000	3.9120	1.4832
1011	3.8709	2.0741
1114	0.7726	1.5055
1124	3.1630	1.2912
1125	4.2004	1.7612
1151	0.2230	1.4828
1162	2.8066	1.7925
1165	0.2080	1.6271
1170	3.6250	1.7647
1172	1.6677	0.8752
1176	1.1870	2.7626
1193	3.2477	1.5795
1197	3.8022	2.0783
1201	4.2487	2.3931
1207	3.4958	1.4706
1218	3.5731	1.4610
1236	3.5084	1.8222

1247	4.2655	2.1445
1287	1.7079	3.4400
1329	2.7779	3.0723
1371	0.2114	1.5380
1379	0.7242	2.9286
1381	2.9861	1.4477
1432	2.7841	2.3000
1444	3.0387	1.4581
1456	3.8135	1.5387
1457	3.3657	1.5699
1458	1.3574	2.9162
1466	3.0390	1.1960
1468	0.8644	2.6977
1482	1.7239	3.4982
1506	0.2448	1.4688
1529	0.6421	0.8192
1532	3.4722	1.3478
1535	3.2309	1.6234
1536	4.1580	1.6425

Transformed Response

Obs	COE_ln'	Fit	Resid	Std Resid		
11	1.2675	1.4300	-0.1625	-0.34		X
15	2.2274	1.0158	1.2116	2.50	R	
19	2.4677	1.2271	1.2406	2.56	R	
21	2.6544	1.3780	1.2764	2.63	R	
46	1.6014	1.7573	-0.1559	-0.32		X
55	3.1376	1.5862	1.5514	3.21	R	
116	1.3753	1.5305	-0.1552	-0.32		X
143	1.4828	1.5788	-0.0960	-0.20		X
145	2.3444	1.3002	1.0442	2.17	R	X
155	1.1121	2.1862	-1.0741	-2.21	R	
169	2.9145	1.5693	1.3452	2.77	R	
184	2.8024	1.7466	1.0559	2.18	R	
189	3.0011	1.8732	1.1278	2.33	R	
207	2.7705	1.7405	1.0301	2.13	R	
236	1.5646	1.1773	0.3873	0.80		X
247	0.4244	1.4246	-1.0002	-2.06	R	
260	1.9799	1.9363	0.0437	0.09		X
262	1.1104	2.5366	-1.4262	-2.95	R	
283	2.7391	1.5595	1.1796	2.44	R	

288	0.9010	2.1596	-1.2585	-2.61	R	
294	0.6160	1.6124	-0.9964	-2.05	R	
296	2.9232	1.6902	1.2330	2.55	R	
309	0.3807	2.1382	-1.7575	-3.62	R	
356	2.6566	1.5656	1.0909	2.25	R	
375	2.2650	1.2317	1.0334	2.13	R	
426	2.3044	1.2698	1.0346	2.14	R	
431	3.0677	2.0664	1.0013	2.06	R	
453	2.4938	1.2503	1.2435	2.58	R	X
474	0.5555	1.5679	-1.0125	-2.09	R	
481	2.9434	1.5459	1.3975	2.88	R	
540	2.6130	0.9861	1.6270	3.38	R	X
542	1.6170	1.1830	0.4340	0.90		X
554	3.1088	1.5668	1.5421	3.18	R	
564	0.4461	1.4654	-1.0194	-2.10	R	
609	2.7823	1.3843	1.3981	2.88	R	
626	1.0414	2.4054	-1.3640	-2.81	R	
633	2.5481	1.2294	1.3188	2.72	R	
638	2.8321	1.6812	1.1509	2.38	R	
645	2.5911	1.3249	1.2662	2.63	R	X
751	2.3950	1.4038	0.9912	2.05	R	
761	0.5146	1.5348	-1.0202	-2.10	R	
779	2.0784	1.8266	0.2518	0.52		X
794	0.7919	0.8629	-0.0710	-0.15		X
806	2.7162	1.1274	1.5887	3.27	R	
809	2.4338	1.4045	1.0293	2.12	R	
821	1.0328	2.3063	-1.2735	-2.62	R	
869	3.0680	1.4252	1.6428	3.38	R	
870	1.2026	1.4578	-0.2552	-0.53		X
874	2.7888	1.5208	1.2680	2.62	R	
876	2.5890	1.4923	1.0967	2.26	R	
887	3.0174	1.4723	1.5451	3.19	R	
894	1.2383	0.7238	0.5145	1.07		X
896	1.1452	2.1188	-0.9736	-2.01	R	
905	2.7462	1.4294	1.3168	2.71	R	
911	2.6052	1.4064	1.1988	2.47	R	
917	2.2432	1.4380	0.8052	1.67		X
929	2.6671	1.6114	1.0558	2.18	R	
933	3.1494	1.5676	1.5818	3.26	R	
934	0.8079	2.1594	-1.3515	-2.80	R	
938	2.3947	1.2404	1.1543	2.38	R	
940	1.3535	0.8556	0.4979	1.04		X
951	1.2477	0.5550	0.6927	1.46		X

965	2.4652	1.4089	1.0563	2.18	R	
969	2.2730	1.8396	0.4334	0.90		X
977	2.4828	1.5089	0.9739	2.01	R	
982	2.8177	1.3185	1.4992	3.10	R	
994	2.4106	1.2303	1.1804	2.45	R	X
995	2.8870	1.3672	1.5198	3.14	R	
998	2.4239	1.4204	1.0035	2.08	R	
1000	2.7871	1.3448	1.4423	2.99	R	
1011	2.7651	1.7301	1.0350	2.14	R	
1114	0.8237	1.3599	-0.5362	-1.11		X
1124	2.3757	1.2117	1.1640	2.41	R	
1125	2.9402	1.5301	1.4101	2.91	R	
1151	0.3238	1.3445	-1.0207	-2.10	R	
1162	2.1716	1.5505	0.6212	1.29		X
1165	0.3073	1.4417	-1.1344	-2.34	R	
1170	2.6320	1.5324	1.0997	2.27	R	
1172	1.4686	0.9047	0.5639	1.17		X
1176	1.1375	2.1460	-1.0085	-2.08	R	
1193	2.4234	1.4099	1.0135	2.09	R	
1197	2.7281	1.7327	0.9954	2.06	R	
1201	2.9655	1.9265	1.0390	2.15	R	
1207	2.5612	1.3361	1.2251	2.53	R	
1218	2.6036	1.3296	1.2740	2.62	R	
1236	2.5681	1.5697	0.9984	2.07	R	X
1247	2.9743	1.7741	1.2002	2.48	R	
1287	1.4952	2.5304	-1.0353	-2.14	R	
1329	2.1549	2.3244	-0.1695	-0.35		X
1371	0.3111	1.3819	-1.0709	-2.21	R	
1379	0.7846	2.2422	-1.4575	-3.00	R	
1381	2.2752	1.3205	0.9546	1.98		X
1432	2.1585	1.8699	0.2886	0.60		X
1444	2.3052	1.3276	0.9776	2.01	R	
1456	2.7342	1.3824	1.3518	2.78	R	
1457	2.4893	1.4034	1.0858	2.24	R	
1458	1.2581	2.2350	-0.9770	-2.02	R	
1466	2.3054	1.1440	1.1614	2.40	R	
1468	0.8963	2.1080	-1.2117	-2.50	R	
1482	1.5057	2.5625	-1.0568	-2.18	R	
1506	0.3473	1.3350	-0.9876	-2.03	R	
1529	0.7169	0.8608	-0.1439	-0.30		X
1532	2.5482	1.2514	1.2968	2.67	R	
1535	2.4140	1.4392	0.9747	2.01	R	
1536	2.9178	1.4519	1.4659	3.02	R	

```
COE_ln' = transformed response
R  Large residual
X  Unusual X
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