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***ASSOCIAÇÃO DE POLITÉCNICOS DO NORTE* (APNOR)**

INSTITUTO POLITÉCNICO DE BRAGANÇA

Ratios and indicators that determine return on equity

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Final Dissertation presented to *Instituto Politécnico de Bragança*

To obtain the Master Degree in Management, Specialisation in Business Management

Supervisors:

Prof. Dr. Jose Carlos Lopes

Prof. Dr. Alcina Maria de Almeida Rodrigues Nunes

Prof. Dr. Lusine Aghababyan

Bragança, May, 2016.

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Abstract

This study aims to investigate factors that may affect return on equity (ROE). The ROE is a gauge of profit generating efficiency and a strong measure of how well the management of a firm creates value for its shareholders. Firms with higher ROE typically have competitive advantages over their competitors which translates into superior returns for investors. Therefore, seems imperative to study the drivers of ROE, particularly ratios and indicators that may have considerable impact. The analysis is done on a sample of 90 largest non-financial companies which are components of NASDAQ-100 index and also on industry sector samples. The ordinary least squares method is used to find the most impactful drivers of ROE. The extended DuPont model's components are considered as the primary factors affecting ROE. In addition, other ratios and indicators such as price to earnings, price to book and current are also incorporated. Consequently, the study uses eight ratios that are believed to have impact on ROE. According to our findings, the most relevant ratios that determine ROE are tax burden, interest burden, operating margin, asset turnover and financial leverage (extended DuPont components) regardless of industry sectors.

Keywords: return on equity, ratio analysis, DuPont model, return on equity ratios/indicators

Resumo

Nesta dissertação os potenciais fatores importantes que afetam a rentabilidade sobre os capitais próprios são investigados. A rentabilidade sobre os capitais próprios é um indicador da eficiência em termos de geração de lucro e uma forte medida da eficácia com que a gestão de uma empresa cria valor para os seus acionistas. As empresas com maior rentabilidade sobre os capitais próprios possuem vantagens competitivas sobre os seus concorrentes o que se traduz em retornos superiores para os investidores. Assim, é fundamental estudar os fatores potenciadores da rentabilidade sobre os capitais próprios, especialmente os rácios e indicadores que podem ter um maior impacto. O estudo efetua-se utilizando uma amostra baseada em 90 empresas componentes do índice NASDAQ-100. O método dos mínimos quadrados ordinários é utilizado para identificar e quantificar os fatores impactantes da rentabilidade sobre os capitais próprios. As componentes do modelo DuPont são utilizadas como base para identificação dos principais fatores que afetam a rentabilidade dos capitais próprios. Adicionalmente, são utilizados outros rácios/indicadores tais como o “PER”, “price to book” and “current ratio”. Consequentemente, são utilizados oito rácios/indicadores que podem determinar a rentabilidade dos capitais próprios. Os resultados obtidos sugerem que os rácios/indicadores mais relevantes na determinação da rentabilidade dos capitais próprios são o “nível de fiscalidade (ou carga fiscal)” “os encargos financeiros”, a “margem operacional”, a “rotação do ativo” e a “alavancagem financeira”, independentemente dos setores de atividade.

Palavras-chave: rentabilidade dos capitais próprios, rácios financeiros, DuPont model, análise financeira

Ամփոփում

Մագիստրոսական աշխատանքը ուսումնասիրում է սեփական կապիտալի շահութաբերության վրա ազդող գործոնները: Սեփական կապիտալի շահութաբերությունը շահույթ ստեղծելու արդյունավետության չափման միջոց է, որը գնահատում է թե ընկերության ղեկավարությունը ինչ էֆֆեկտիվությամբ է շահույթ գոյացնում բաժնետերերի համար: Սեփական կապիտալի բարձր շահութաբերություն ունեցող ընկերությունները սովորաբար ունեն մրցակցային առավելություններ այլ ընկերությունների նկատմամբ, որն իր հերթին ներդրողների համար ապահովում է բարձր եկամուտներ: Այս առումով կարևորվում է սեփական կապիտալի շահութաբերության վրա ազդող գործոնների ուսումնասիրությունը. մասնավորապես այն գործակիցների և ցուցանիշների, որոնք զգալիորեն ազդում են սեփական կապիտալի շահութաբերության վրա: Հետազոտությունը կատարվել է ոչ միայն 90 խոշորագույն ոչ ֆինանսական ընկերությունների օրինակի վրա, որոնք հանդիսանում են Նասդաք-100 ինդեքսի բաղադրիչներ, այլև այլ ոլորտների: Սեփական կապիտալի շահութաբերության վրա ազդող գործոնները բացահայտելու համար օգտագործվել է փոքրագույն քառակուսիների ռեգրեսիոն անալիզի մեթոդը: Այս աշխատանքում ընդլայնված Դուպոնտ մոդելի բաղադրիչները օգտագործվում են ինչպես սեփական կապիտալի շահութաբերության վրա ազդող հիմնական գործոններ: Աշխատանքում ընդհանուր առմամբ ընդգրկված են թվով ութ գործակիցներ և ցուցանիշներ, որոնք կարող են ազդել սեփական կապիտալի շահութաբերության վրա: Ըստ հետազոտության արդյունքների, անկախ ոլորտից, սեփական կապիտալի շահութաբերության վրա ազդող գործոններն են ընդլայնված Դուպոնտ բաղադրիչները:

Առանցքային բառեր. սեփական կապիտալի շահութաբերություն, գործակիցների վերլուծություն, Դուպոնտ մոդել, սեփական կապիտալի շահութաբերության գործակիցներ և ցուցանիշներ

Resumen

En esta tesis se investigan los factores importantes que afectan la rentabilidad de fondos propios. El retorno de fondos propios es un indicador de eficiencia en términos de generación de ganancias y una medida importante de la eficacia con la que la gestión de una empresa crea valor para sus accionistas. Las empresas con la más alta rentabilidad de fondos propios tienen ventajas competitivas sobre sus competidores que se traduce en rentabilidades superiores para los inversores. Por lo tanto, es esencial estudiar los factores potenciadores de la rentabilidad de los fondos propios, especialmente los ratios e indicadores que pueden tener un mayor impacto. El estudio se lleva a cabo con una muestra empresarial de 90 empresas del índice NASDAQ-100. El método de mínimos cuadrados ordinarios se utiliza para identificar y cuantificar los factores que afectan la rentabilidad de los fondos propios. Los componentes del modelo DuPont se utilizan como base para la identificación de los principales factores que afectan el retorno de los fondos propios. Además, se utilizan otros indicadores de relaciones como “PER”, “price to book” y “current ratio”. Por lo tanto, son usados ocho ratios/indicadores que pueden determinar el retorno de los fondos propios. Los resultados obtenidos sugieren que los indicadores ratios/indicadores más relevantes para determinar el retorno de los fondos propios son el “nivel de impuestos”, “gastos financieros”, la “margen operativa”, “rotación del activo” y “apalancamiento financiero”, independientemente del sector de industria.

Palabras clave: Rentabilidad sobre fondos propio, ratios financieros, Dupont model, análisis financiera

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Acronyms

ROE - Return on equity

TB - Tax burden

IB - Interest burden

OM – Operating margin

AT – Asset turnover

FL – Financial leverage

PE – Price to earnings ratio

PB – Price to book ratio

CUR – Current ratio

OLS - Ordinary least squares

VIF- Variance inflation factor

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Introduction

The aim of this study is to analyze and explain factors (ratios and indicators) which are believed to have a significant impact on return on equity (ROE). The main goal of a company is the generation of profit and maximization of shareholders' equity. Glancing at corporate finance textbooks and literature ample information is found on shareholder wealth maximization being the primary goal of corporations. Brealey, Myers and Allen (2006), Brigham and Ehrhardt (2011) and many others argue that maximizing the market value of a firm offers the most essential objective function which is necessary for the efficient management of a firm. Thus, the importance of return on equity as a profitability indicator becomes evident taking into account the fact that it measures how effectively the management generates wealth for shareholders. However, the deeply analysis of profitability (return on equity) is a demanding and complicated process. Padake and Soni (2015), Herciu, Ogrean and Belascu (2011) along with other studies have identified that an absolute profitability measure doesn't provide reliable results and only by grouping several profitability ratios it is possible to achieve meaningful outcomes.

DuPont model clarifies this issue as it presents ROE as a profitability measure and gives information about the drivers of ROE. With DuPont model the main issue of absolute profitability is resolved as the latter simply reflects capital not how well company's assets are utilized. DuPont model is a widely used gauge of profitability which links several factors to ROE. Liesz and Maranville (2011) have found that extended DuPont formula adds more to ratio analysis and through decomposition links ROE to many ratios. Therefore, to gain a deeper understanding of the drivers of ROE "Really" modified DuPont model's components taking into account in this study.

In addition to DuPont components other indicators of market and financial profitability such as price-to-earnings, current and book-to-market ratios are incorporated into the analysis. These ratios are believed to have relevant impact on return on equity. Therefore, is it important to find out what ratios/indicators determine the return on equity. To achieve this objective, the OLS (ordinary least squares regression) analysis is applied to the components (90 companies) of Nasdaq-100 index to learn which ratios/indicators have greater explanatory power regarding return on equity. Two models are used for the empirical analysis. The first model uses original units of measure. Whereas, the second model uses logarithmic values. The OLS regression analysis is firstly applied on all companies (global sample). Next, the OLS regression analysis is also conducted on industry sectors, namely technology sector, consumer sector and other sector (residual sector) to find evidence on how different industry characteristics influence the return on equity.

The thesis is structured as follows. After this introduction, in the second section, ratio/indicators framework and literature review is presented and discussed; including the origin, development and decomposition of DuPont model. Section 3 explains the data and methodology used to explain cross-sectional analysis. In section 4, the main empirical results are presented and discussed for four samples: global, technology, consumer and other including descriptive statistics, Pearson correlation and OLS regression analysis. In addition, comparative analysis of the results is presented, where the main findings of the thesis are elaborated and compared with previous research. Finally, the main conclusions of the research are presented and discussed as well as its limitations. Besides, further research directions are suggested.

1. Ratios/indicators framework and literature review

1.1 Financial ratios and indicators

A ratio expresses a mathematical relationship between two quantities Babalola and Abiola (2013). Financial ratios are used to compare various figures from financial statements in order to gain information about company's overall performance. While computation of a ratio is a simple arithmetic operation, its interpretation is more complex Babalola et al., (2013). In this respect, it is the interpretation rather than the calculation that makes financial ratios a useful tool for market participants. Ratio analysis is defined as systematic use of ratios to interpret the financial statements so that the strengths and weaknesses of a firm as well as its historical performance and current financial position can be determined Sahu and Charan (2013). Information required for ratio analysis is derived from financial statements and some ratios often link accounts from different financial statements such as balance sheet and income statement. Financial ratios can be interpreted as hints, indicators or red flags concerning notable associations between variables used to assess the company's performance. Some of the most important questions to be answered are whether all resources were used effectively, whether the profitability of the business met or even exceeded expectations, and whether financing choices were made prudently. Shareholder value creation ultimately requires positive results in all these areas which will bring about favorable cash flow patterns exceeding the company's cost of capital Helfert (2001). Financial ratio analysis can be used in two different but equally useful ways. It can be used to explore current state of the company in comparison to its past performance, in other words, it tracks financial performance over time. Comparing current performance to past performance is very useful as it enables a market participant to identify issues that need fixing. Moreover, a manager can discover potential problems that can be avoided. By making trend-analysis which compares a specific ratio over years it is possible to evaluate how is company performing over time and whether it has improved its financial health or not. In trend-analysis a ratio serves as a red flag for worrying problems or a benchmark for performance measurement. Firm performance can be also measured by making comparative analysis. A ratio can be compared with industry average to find out

whether a firm is lagging in performance or doing well. Financial ratio analysis can be used both by internal and external parties. External users can be creditors, security analysts, potential investors, competitors and others. Internal users such as managers use ratio analysis to monitor company's performance and to assess its strengths and weaknesses.

According to Helfert (2001) before undertaking any task, it is critical to define following elements:

- The viewpoint taken;
- The objectives of the analysis;
- The potential standards of comparison.

Ratio analysis is meaningful when the viewpoint taken and objectives of the analysis are clearly defined. Obviously, there should be consensus between the viewpoint taken and the objective of the analysis. While conducting ratio analysis a market participant should find out if there are similar companies in the same industry or if the industry average is available. Ratio analysis is only meaningful when it is compared to some benchmark. Different industries have various characteristics and a ratio may vary from industry to industry to a significant degree. Therefore, it is crucial to have a benchmark of comparison. Along with apparent benefits of ratio analysis there are some major precautions that every market participant should exercise when making ratio analysis.

- Ratios should be used in appointed combinations
- Ratio analysis should be used in industry context as different industries have different characteristics.
- Ratios need to be compared to industry norms to gain an understanding if a specific company is doing well in the industry or falling behind compared to its peers.
- Huge companies may have different lines of businesses which can cause bias in aggregate financial ratios.
- Due to different accounting standards some ratios could be contorted as a result of differences in financial statements.

Ratios are not absolute criteria. They serve best when appointed in combinations to identify changes in financial conditions or overall performance over several years and compared to similar firms or industry average. According to Helfert (2011) in order to conduct financial analysis it is necessary that a combination of primary and secondary measures are used. Assessing a business performance always provides answers that are relative as business and operating conditions are very different from firm to firm and industry to industry. For this reason, industry average serves as an important point of comparison for firms operating in a same industry. Results of trend analysis is particularly difficult to interpret for huge multi-business companies and conglomerates, where information about individual business line is negligible or not available. Accounting adjustments is another complex issue. Companies reporting under different accounting standards have differences in accounts of financial

statements. In this respect, comparison of financial ratios becomes very complex when companies report under different accounting standards.

Generally, ratios are classified into broad categories in respect to what aspects of performance a ratio is intended to measure. There are many labels both for categories and ratios used by literature. In this subsection common ratio categories are represented which are summarized in Table 1.

Table 1. Categories of financial ratios

Category	Explanation
Activity	Activity ratios measure the efficiency of a company in using its resources (assets)
Liquidity	Liquidity ratios measure the ability of a company to meet its short-term debts obligations
Solvency	Solvency ratios measure the company's ability company to meet its long-term debts obligations
Profitability	Profitability ratios measure the company's ability to generate earnings from its assets
Valuation	Valuation ratios measure whether a particular security is cheap or expensive when compared to a certain measure.

Source: Authors own elaboration

Activity ratios are accounting ratios that assess the firm's ability to transform various accounts within its balance sheet into cash or sales. Activity ratios are intended to measure firm's efficiency in using its assets or other balance sheet items. Activity ratios are also known as asset utilization ratios or operating efficiency ratios. These ratios determine whether company's management is effective in generating revenue from its resources. Moreover, these ratios determine the efficient management of both working capital and longer term assets. Hence, activity ratios are closely connected to liquidity ratios. These ratios generally combine items from balance sheet and income statement. It is notable, that balance sheet items are represented as averages to achieve consistency. Activity ratios are critical in assessing a firm's fundamentals as they not only express how well a firm generates revenues but also indicate how well the firm is being managed. To sum up, activity ratios are financial analysis tools used to gauge the ability of a firm to transform various asset, liability and capital accounts into revenue. Firms that are able to convert its assets into revenue faster than others are more efficient.

Liquidity ratios are class of financial metrics used to measure a company's ability to cover its short term debts obligations. These ratios also determine a company's capability to sell assets in order to quickly generate cash. The liquidity ratios show how many times short-term obligations are covered by cash and liquid assets. There are three major liquidity ratios used by market participants to analyze a company's ability to pay its short term obligations. Current, quick and cash ratios are the most common liquidity ratios used in the literature. Current ratio is the most comprehensive as it expresses current assets relative to current liabilities. Quick ratio includes only more liquid current assets relative to

current liabilities. The cash ratio is a more reliable measure in crisis situations as it includes cash and short-term marketable investments.

Solvency ratios are used to assess a company's ability to meet its long-term debt commitments. These ratios indicate whether a company's cash flow is enough to meet its short-term and long-term liabilities. Solvency ratios are useful in providing information about company's relative amount of debt in its capital structure and whether the company generates enough revenues and cash flow to cover its interest expenses and different fixed charges. Lower solvency ratios indicate higher probability that a company will default on its debt obligations. Leverage is classified into two major types: operating leverage and financial leverage. Market participants attempt to understand company's use of debt as the leverage has a magnifying effect. Operating leverage measures the amount of fixed costs used to conduct day-to-day activities. Therefore, profitable companies tend to increase their use of operating leverage in order to enhance operating income at a faster rate when company's revenues increase. The reason behind increased use of operating leverage is that variable costs rise proportionally with revenue, however fixed costs do not. Financial leverage measures the use of debt to obtain additional assets. Debt usage makes up leverage since interest payments are fixed financing costs. In this respect, financial leverage amplifies the effect of changes in earnings before interest and taxes on returns allocating to shareholders. However, increasing debit in company's capital structure enhances the risk of default.

Profitability ratios are used to evaluate a company's ability to generate revenue relative to sales, assets and equity. These ratios essentially indicate company's overall value as well as the value of securities it issues. They highlight how effectively the profitability of a company is being managed. Income statement is used to calculate profitability ratios as it shows the sources of earnings and the elements of revenue and expenses. Profitability ratios provide useful insights into the financial health and the overall performance of a company. There are not only return on sales profitability ratios but also return on investment profitability ratios. The former present different subtotals of income statement such as: operating profit, net profit and gross margin relative to revenue, whereas, the latter assesses income relative to assets, equity or total capital utilized in the company.

Valuation ratios measure how cheap or expensive a security or business is compared to some measure of profit or value. Generally, valuation ratios are calculated by dividing a measure of price by a measure of value or in reverse. Price-to-earnings ratio is the most widely used and best known of the investment valuation indicators. It tells how much an investor in common stocks pays per dollar of earnings. Price-to-book or book-to-market ratio is another important valuation ratio which compares share price to the value of company's assets. This ratio is often interpreted as an indicator of market's sentiment about the relation between company's required rate of return and its actual rate of return. Enterprise value to earnings before interest and taxes is another valuation ratio. It compares the cost of buying a company without debt to profits.

1.2 The DuPont model

The DuPont model was first introduced by F. Donaldson Brown, an electrical engineer by education who joined the giant chemical company's Treasury department in 1914. After few years, DuPont bought 23 percent of the stock of General Motors Corp. and Brown was given the task of cleaning up the car maker's tangled finances. The DuPont model is credited to Brown as he attempted to find a mathematical relationship between two commonly computed ratios, namely net profit margin and total asset turnover. Original DuPont model was firstly used in internal efficiency report in 1912 which was the product of profit margin (a measure of profitability) and asset turnover (a measure of efficiency). The formula of original DuPont model is illustrated below in equation 1.

$$\text{Return on Assets (ROA)} = \frac{\text{Net income}}{\text{Sales}} \times \frac{\text{Sales}}{\text{Asset turnover}} = \frac{\text{Net Income}}{\text{Asset turnover}} \quad (1)$$

The maximization of ROA was considered a major corporate goal and the realization that ROA was impacted by both profitability and efficiency led to the development of a system of planning and control for all operating decision in a firm Liesz (2002). In this respect, DuPont analysis was incorporated in many companies as a strong measure of company's efficiency until 1970s. After 1970s the common corporate goal of ROA maximization shifted to ROE maximization and it led to a major modification of the original DuPont model. Debt financing (leverage) became the third area of interest for financial managers which was added to the original DuPont model as equity multiplier. The modified DuPont model is shown below in equation 2 and 3.

$$\text{Return on Equity (ROE)} = \text{ROA} \times \frac{\text{Total assets}}{\text{shareholder'equity}} \quad (2)$$

$$\text{ROE} = \frac{\text{Net profit}}{\text{Sales}} \times \frac{\text{Sales}}{\text{Total assets}} \times \frac{\text{Total assets}}{\text{Shareholder's equity}} \quad (3)$$

DuPont analysis not only measures profitability but also explores how the company can yield return even with debt and how it can generate cash and produce more sales with each asset. DuPont analysis links balance sheet to income statement. It helps to spot areas within a company that are stronger or weaker. A top-profit business exists to generate wealth for its owners. ROE is, therefore, arguably the most important of the key ratios, since it indicates the rate at which owner wealth is increasing. It is obvious that DuPont analysis is not an adequate substitute for detailed financial

analysis as it has certain drawbacks. However, it is an excellent tool to get a quick overview of company's strengths and weaknesses. DuPont model covers the following areas: profitability, operating efficiency and leverage.

i. Profitability: Net Profit Margin

Profitability ratios are a class of financial metrics that are used to assess a business's ability to generate earnings as compared to its expenses and other relevant costs incurred during a specific period of time (Investopedia, 2016). Gross, operating and net profitability are the most broadly used measures, which describe performance at different activity levels. Net profitability is the most comprehensive since it uses the bottom line net income in its measure. Essentially, NPM (net profit margin) is the percentage of revenue remaining after all operating, interest, taxes and preferred stock dividends have been deducted from a company's total revenue. It is the best measure of profitability since it shows how good a company is at converting revenue into profits available for shareholders.

ii. Asset Utilization: Total Asset Turnover

Turnover or efficiency ratios are of significant importance as they indicate how well the assets of a firm are employed to generate sales and/or cash. The efficiency ratio is a ratio that is typically used to analyze how well a company uses its assets and liabilities internally (Investopedia, 2016). Although, profitability is important it doesn't always provide the complete picture of how well a company provides a product or service. A company is profitable very often, but not too efficient. Profitability is derived from accounting measures of sales revenue and costs. Matching principle of accounting enables such measures to be generated, which registers revenue when earned and expenses when incurred. In this respect, a disparity may occur between the goods sold and the goods produced during that same period. In fact, goods produced but not sold will appear in financial statements as inventory assets at the end of the year. It is obvious that a firm with unusually large inventory balances is not performing effectively. The main purpose of efficiency ratios is to reveal problems like this that need fixing. The total asset turnover ratio measures the efficiency of asset deployment in generating revenue. The most comprehensive measure of performance in activity category is being employed in the DuPont system (other measures being fixed asset turnover, working capital turnover, inventory and receivables turnover) which clearly are not as informative as net profitability.

iii. Leverage: The Leverage Multiplier

A leverage ratio is any one of several financial measurements that look at how much capital comes in the form of debt (loans), or assesses the ability of a company to meet financial obligations (Investopedia, 2016). Debt financing is both beneficial and costly for a firm. In fact, the cost of raising debt is less than the cost of raising equity. This effect is augmented by the tax deductibility of interest expenses contrary to taxable dividend payments and stock repurchases. In this respect, if earnings of debt are invested in projects which have substantial returns (more than the cost of debt), owners are

able to retain the residual and hence, the return on equity is "leveraged up." However, accumulation of debt forms a fixed payment to be made periodically by the firm whether or not it is generating an operating profit. Therefore, if the company is doing poorly those payments may cut into the equity base. Furthermore, the risk of the equity position is enhanced by the presence of debt holders having a greater claim to the assets of the firm. The leverage multiplier employed in the DuPont ratio is explicitly related to the proportion of debt in the firm's capital structure.

Yet another modification was introduced by Hawawini and Viallet (1999) to the DuPont model. The “really” modified DuPont model consists of five ratios that combine to form the ROE.

The “really” modified DuPont model is shown below in equation 4 and 5

$$\frac{Net\ Income}{Avg.\ shareholders'\ equity} = \frac{\text{Net income}}{\text{EBIT}} \times \frac{EBT}{\text{EBIT}} \times \frac{EBIT}{Revenue} \times \frac{Revenue}{Avg.\ total\ assets} \times \frac{Avg.\ total\ assets}{Avg.\ shareholders'\ equity} \quad (4)$$

Where:

EBIT- earnings before interest and taxes

EBT- earnings before taxes

$$ROE = Tax\ burden \times Interest\ burden \times EBIT\ margin \times Total\ asset\ turnover \times Leverage \quad (5)$$

This “really” modified model still maintains the importance of the impact of operating decisions (i.e. profitability and efficiency) and financing decisions (leverage) upon ROE, but uses a total of five ratios to uncover what drives ROE and give insight to how to improve this important ratio Liesz (2002).

The first item on the right-hand side of equation 5 is called Tax burden which measures the effect of taxes on ROE. It measures how much of company’s pretax profit is kept. The second item is called interest burden which measures the effect of interest on ROE. Higher borrowing costs result in lower ROE. The third item measures the impact of operating profitability on ROE. The fourth item is the asset turnover which measures how effectively the company utilizes its assets to generate revenue. The fifth item is financial leverage which is the total amount of company’s assets relative to its equity capital. The decomposition is a useful tool for market participants as it expresses a company’s ROE as a function of its tax rate, interest burden, operating profitability, efficiency and leverage. Modified DuPont model can be used by market participants to determine what factors are driving company’s ROE.

In conjunction with extended DuPont components additional ratios which are outside of the scope of DuPont model are incorporated in this study. PE ratio is included in this study as a measure of share value. PE ratio shows whether company's stock is properly valued or not. Next ratio we wanted to add in this study is the current ratio. Essentially, current ratio measures a company's ability to pay its short-term liabilities. It expresses current assets in relation to current liabilities. Higher ratio indicates a greater ability to meet short-term obligations. It is useful in terms of providing information about company's liquidity. Finally, the book-to-market ratio is included in the analysis as a measure of a company's value. B/M ratio is the ratio of the market value of equity to the book value of equity.

1.3 Literature review

There is significant and expanding literature on the use of ratios/indicators and the DuPont model. The literature mainly focuses on the viability and effectiveness of DuPont model as a gauge of overall firm profitability. However, there is very little research and evidence concerning to the factors affecting ROE.

According to Liesz and Maranville (2011) to perform DuPont analysis few simple calculations are required. They justified that these calculations lead to meaningful results for small businesses. The authors stress the idea that even with the original model it is possible to get valuable insights in return, however, extended modified DuPont analysis clarifies relatively complex financial analysis and gives managers the ability to effectively conduct strategic and financial planning.

Soliman (2008) analyze whether the information contained in DuPont analysis is associated with stock market returns and analyst forecasts. The author examines the decomposition of earnings which is asset turnover, profit margin and market's association with the DuPont components both in long and short-window tests. The results of the study assert that asset turnover has an explanatory power for future changes in return on net operating assets (RNOA) and that the market understands the future RNOA implications of DuPont components.

Liesz (2002) examines the extended modified DuPont model as a simple tool which can be used by managers, small business owners and other market participants. The author claims that the model simplifies complicated financial analysis and is an effective tool to identify how the DuPont components affect ROE.

Saleem and Rehman (2011) examine the relationship between liquidity and profitability of oil and gas companies of Pakistan. Their results show that there is a significant impact of only liquid ratio on return on assets (ROA) while insignificant on ROE and return on investment (ROI). The authors also find that ROE is not significantly affected by three ratios current ratio, quick ratio and liquid ratio, whereas, ROI is greatly affected by current ratio, quick ratio and liquid ratio.

Taani and Banykhaled (2011) examine the relationship between profitability and cash flows. Regression analysis is applied to find out how different factors affect earnings per share (EPS) for 40 companies listed on the Amman stock market. The authors conclude that return on equity, debt to equity, price to book value, cash flow from operating activities and leverage ratios have a significant impact on EPS.

Roaston and Roaston (2012) analyze the impact of five financial and seven market indicator on financial and market performances of eighty-six companies. The authors conclude that according to root mean square error (RMSE) criteria price-to-earnings ratio is a better indicator of financial performance of companies than other indicators.

Herciu and Ogrean (2011) perform DuPont analysis on twenty most profitable companies in the world. The authors stress that company's profitability as an absolute measure is not an effective measure for investors as it provides an overview of company's activity without giving details about the company's management of dividend, debt, liabilities and other indicators. With the help of profitability ratios like return on sale, return on assets and return on equity the authors demonstrate that those absolute measurements are not reliable most of the time and only by relating them to other indicators that clarify the relationship between effect and effort it is possible to achieve meaningful results.

Padake and Soni (2015) analyze the efficiency of top twelve banks in India through DuPont analysis. The authors claim that DuPont analysis provides a much deeper understanding of a firm's efficiency. They conclude that judging a performance of a bank solely by profit or one ratio is not accurate as the banks which made more profit were not more efficient than the others. Thus, profit is reflection of a capital, but not how well a firm utilizes its assets.

Majed and Ahmed (2012) examine the relationship between the return-on-assets, return-on-equity and return-on-investment on Jordanian insurance public companies share prices for the period 2002-2007. The authors conclude that ROA, ROE and ROI together show a strong association with share prices and market returns. However, ROA and ROI have a weak impact on share price individually and ROE has no impact.

Soliman (2004) examine the DuPont analysis within the industry context. According to the author simple decomposition of total profitability using DuPont analysis along with industry adjustment provides an increased predictive ability of future changes in RNOA. The findings are consistent with abnormal asset turnover being more persistent than abnormal profit margin. Furthermore, abnormal profitability derived from abnormal profit margin is less persistent than abnormal profitability derived from abnormal asset turnover.

Fairfield and Yohn (2001) examine whether disaggregation of profitability into asset turnover and profit margin has a forecasting power. The results of the study assert that disaggregation provides information about future profitability. According to the authors, it is the change in components of

profitability, rather than the current mix, that is informative about the future changes in profitability and that market participants should direct their focus to asset turnover as it improves forecasts of future profitability.

Li and Nissim (2014) analyze the impact of profit margin and asset turnover on the volatility of future net operating profit. The authors conclude that both elements of DuPont decomposition, the operating profit margin and asset turnover provide information that forecasts the volatility of operating profit. This paper extends the DuPont analysis into the analysis of risk.

Burja and Marginean (2014) analyze the impact of DuPont components on ROE and asset turnover. The analysis is conducted on five largest Romanian companies of furniture industry for a 13-year horizon. The authors conclude that ROE is positively correlated with return on sales, return on assets and negatively correlated with equity multiplier.

Wu (2014) analyzes the association of forward PE and profitability (return on equity). The authors conclude that PE ratio has a U-shaped relationship with ROE meaning that companies with higher forwards PE ratios generate lower ROE in subsequent years. In addition, the distribution of those companies' realized ROE is more volatile and widespread compared to the firms with lower forward PE ratios.

Katchova and Enlow (2013) use DuPont model to compare ROE components of agribusiness companies. They conclude that asset turnover has the most impact on ROE indicating higher operating efficiency of agribusinesses.

Pech and Noguera (2015) assess the relationships between financial ratios and stock returns. Set of financial ratios is acquired from recommendation reports of leading equity analysts in Mexico. They conclude that reduced set of financial ratios effectively describe stock returns.

Delen, Kuzey and Uyar (2013) use factor analysis to find out the underlying dimensions of financial ratios followed by predictive modeling methods to discover associations between financial ratios and firm performance. The authors conclude that ROE is largely affected by earnings before tax-to-equity, net profit margin, leverage and sales growth ratios.

Penman (1991) tries to evaluate the role of accounting rate of return (ROE) in assessing cross sectional differences in prices and returns. Their findings assert that ROE is better interpreted as a profitability measure rather than a risk measure. Furthermore, they conclude that ROE is not sufficient for distinguishing future profitability, therefore, it's not a satisfactory summary measure for financial statement analysis.

Fama and French (1992) examine whether size and book-to-market equity (B/M) describe average stock returns associated with market β, size, leverage, B/M and earnings-price ratios. The authors conclude that average stock returns are not positively related to β. Another important finding is that for

the period of 1963-1990 size and B/M equity describe cross-sectional variation in average stock returns related to size, E/P, B/M and leverage.

Fama and French (1993) they go one step further in their analysis by trying to find common risk factors in the stock and bond returns. As shown by their previous research B/M equity and size are related to systematic patterns in relative profitability and growth which also could be the source of common risk factors. Their major finding is that size and B/M are related to risk factors that capture strong common variation in stock returns and also help explain the cross-section of average returns. However, as mentioned by authors how the size and B/M factors in returns are driven by the stochastic behavior of earnings is a question yet to be answered.

Fama and French (1995) try to investigate whether variation in stock prices along with book-to-market equity describe the behavior of earnings. Their findings assert that B/M and size are indeed related to profitability.

The literature on DuPont model stresses the idea that financial ratios individually indicate incomplete information of a firm. Incorporating the DuPont model to some extent solves this problem as it links ROE to important areas of firm operations. Therefore, ROE as a measure of profitability is decomposed providing information about the factors that affect ROE. Thus, by observing changes in those factors it is possible to find out which of them affect the ROE most. However, as shown above some studies have also identified other ratios that are not covered by DuPont model and have a strong link to profitability (ROE). In this respect, this study incorporates not only the components of extended DuPont model but also additional ratios and indicators which are deemed important by previous research.

2. Research Methodology

The objective of the study is to identify the main determinants of return on equity from a selected set of financial ratios/indicators and define what is their impact on return on equity. To pursue this objective, the chapter is divided into two subsections. The first subsection describes the database and the econometric methodology chosen for the treatment of data. The second subsection identifies, defines and explains the dependent and independent variables. Moreover, according to the literature review and the researcher's knowledge, the expected relation between each independent variable and the dependent one is presented.

2.1 Data and sample

In order to achieve the main goal of this study, data was collected for the firms that compose the Nasdaq-100 index. The Nasdaq-100 index includes 106 of the largest domestic and international non-financial companies listed on the Nasdaq Stock Market based on market capitalization[1]. The components of the mentioned index are presented in Table 16 of the Appendix 1. All the data concerning financial ratios and indicators used in this research study were obtained from Bloomberg database on the 23th of February, 2016. The data refers to the business year of 2015, and therefore is a cross sectional database (all the variables are measured at the same moment in time).

The data consists of nine variables, namely: return on equity, tax burden, interest burden, operating margin, asset turnover, financial leverage, price-to-earnings, book-to-market and current ratios. All the variables are presented and defined in detail in the previous section and their importance for achieving the objective of the research study is also explained. The primary goal of the research was to use all the components of Nasdaq-100 NDX. However, some ratios for some companies were not available at

[1] http://www.nasdaq.com/markets/indices/nasdaq-100.aspx

the date of information retrieval. Additionally, some outlier values which may bias the results were observed in the database. Therefore, to avoid problems associated with the missing values, 16 observations were excluded from the original research sample. Thus, the final sample available for this study consists of 90 companies. The list of 90 companies, along with their respective industry sector, are presented in table 16,17, 18 and 19 in Appendix1 and 2.

Table 2 depicts the variables used in the study, the abbreviation of their full name, their complete definitions as well as their units of measure and ratios that were used to calculate the variables. The expected relation between each independent variable and the dependent variable (ROE) is also depicted in the table. The (+) and (-) notations are used to explain the type of relationship between each independent variable and the dependent one. The (+) notation indicates a positive relationship with the independent variable, or in other words, a variation in the dependent variable in question influences positively the return on equity. In contrast, the (-) notation indicates the existence of a negative relationship between the selected independent variable and the variable that is being explained, this is, if the dependent variable varies the return on equity will vary in the opposite direction. The (+) notation means that variations in the dependent variable are expected to change the return on equity in the same direction. Whereas, the (-) notation implies that variations in the independent variable are expected to alter the return on equity in an opposite direction.

Regarding the list of selected variables/indicators that can influence the return on equity, they were selected based on existing scientific literature and empirical studies presented in the subsection devoted to the literature review. From the literature referred in the above mentioned subsection 2.3, eight variables/indicators are believed to have a strong influence on the variations of return on equity. The variables are: tax burden, interest burden, operating margin, asset turnover, financial leverage, price to earnings, price to book/ market to book and current[2]. It is noteworthy, that the analysis is not only carried out for all index constituents, but also for two major industry sectors, namely: Technology and Consumer sectors. The index constituents that do not belong to one of the two above mentioned sectors are grouped in a residual sector called "other" sector. The reason behind this decision is that industries have different characteristics resulting in discrepancies in many ratios. Mubin and Iqbal (2014) agree that there is a sector impact on ROE. Therefore, industry analysis is crucial to make a comparison between industries checking if all indicators provide the same important insights for different industries and how those differences alter return on equity.

Tax burden, interest burden, operating profitability, asset turnover and financial leverage indicators are the components of the extended DuPont model which explains the return on equity. In this respect, the reason behind the inclusion of these variables into the analysis is very obvious - they all have a direct impact on return on equity, as the decomposition explicitly links them to return on equity. The price to earnings ratio and the price to book ratio were previously documented to have impact on profitability.

[2] The formulas used to calculate these variables are presented in Table 2

According to Saleem et al., (2011) they were the first who attempted to link profitability and liquidity measures. They found that liquidity measures are not related to return on equity. A liquidity measure (current ratio) is incorporated in this study to further study the relationship between liquidity and profitability measures. For this reason, and in conjunction with the extended DuPont components, these variables were also included in the analysis as explanatory variables for the change in the return on equity.

The unit of measure of the variables is either euro amounts or percentages. Formulas depicted in Table 2 can differ from other sources as different databases use different formulas to calculate indicators. The ratios from table 2 are acquired from the Bloomberg database and were used to calculate the independent variables/indicators.

Table 2. Description of dependent and independent variables and the expected relation between them

Variable	Abbrevation	Description	Ratio	Unit of measure	Type of association
Return on equity	ROE	Amount of income returned as a percentage of shareholders equity	$ROE = \frac{Net\ income\ available\ for\ common\ shareholders}{average\ total\ common\ equity} \times 100\%$	%	n/a
Tax burden	TB	The proportion of the company's profits retained after paying income taxes	$TB = \frac{Net\ income\ available\ for\ common\ shareholders}{Pre-tax\ income} \times 100\%$	%	+
Interest burden	IB	Measures the effect on interest on ROE	$IB = \frac{Pre-tax\ income}{Operating\ income\,(loss)} \times 100\%$	%	+
Operating margin	OM	Measures how much is lefot of revenue cosidering cost of goods sold and operating expenses	$OM = \frac{Operating\ income}{Net\ sales} \times 100\%$	%	+
Asset turnover	AT	Measures the efficiency of a company's use of its assets in generating sales revenue	$AT = \frac{Net\ sales}{Average\ total\ assets}$	€	+
Financial leverage	FL	Is the use of borroewed capital to increase potential return of an investment	$FL = \frac{Average\ total\ assets}{Averahe\ total\ common\ equity}$	€	(+) / (-)
Price-to-earnings	PE	Measures a company's current share price relative to its per-share earnings	$\mathrm{PE} = \frac{Last\ price}{Earnings\ per\ share}$	€	-
Price-to-book	PB	Compares a stock's market value to its book value	$\mathrm{PB} = \frac{Last\ price}{Book\ value\ per\ share}$	€	+
Current ratio	CUR	Measures a company's ability to cover its short-terrm liabilities with its current assets	$CUR = \frac{Current\ assets}{Current\ liabilities}$	€	+

Note: The ratios are acquired from Bloomberg database and were used to calculate the variables in study. The notation n.a. means that is an expected relation is not applicable. ROE is the dependent variable

Source: Author's calculations using Bloomberg data retrieved on 23.02.2016

2.2 Methodology and data treatment

With respect to methodology of inferential data analysis, the Ordinary Least Squares (OLS) regression method is used in this study to both identify the most relevant indicators that explain the changes on return on equity and to quantify the relation between each indicator and the return on equity. In other words, the OLS regression method is applied to find out which variables have the most explanatory power or variations occurring in return on equity quantifying that explanatory power.

In this study, it is intended to determine which among eight selected variables influence return on equity of companies operating in Nasdaq-100 NDX index. The existence of more than an explanatory variable puts the present analysis in the framework of a multiple linear regression analysis. In this case, the dependent variable (return of equity) in approximately linearly related to the independent variables (tax burden, interest burden, operating margin, asset turnover, financial leverage, price to earnings, price to book/ book to market and current), and can be represented by the following equation:

$$ROE_i = \alpha + \beta_1 TB_i + \beta_2 IB_i + \beta_3 OP_i + \beta_4 AT_i + \beta_5 FL_i + \beta_6 PE_i + \beta_7 PB_i + \beta_8 CUR_i + \varepsilon_i \quad (6)$$

Where, α represents a constant, β the coefficient of each independent variable that is estimated by the OLS method and describes the power of explanation of each independent variable, ε_i the error term associated with all stochastic relations (as the economic relations are). Finally, i represents each one of the observations in the dataset, that is, each one of the firms in the sample ($i = 1, 2, 3, \dots, 90$).

The OLS procedure is the simplest type of estimation procedure used in statistical empirical analyses and therefore is one of the most frequently used methods concerning analysis of economic nature. (Wooldridge, 2012). Under certain assumptions (some that are important to guarantee the possibility of model estimation and the unbiased and trustworthy results and others that guarantee the quality of such results), the method of ordinary least squares has some very attractive statistical properties that have made it one of the most powerful and popular methods of regression analysis (Gujarati, 2010).

The assumptions that are important to guarantee the model estimation and to achieve unbiased results in this particular empirical cross sectional study are the following ones: (1) the model must be linear in the parameters; (2) the data are a random sample of the population, i.e., residuals are statistically independent/uncorrelated from each other; (3) the independent variables are not too strongly collinear; and, (4) the independent variables are measured precisely such that measurement error is negligible. Assumption (1) is verified, the estimations which results will be presented in the next section are linear in the parameters. Assumption (2) is called homoscedasticity and is difficult to guarantee in cross

sectional databases. The violation of such assumption makes the results of the OLS estimator biased and inconsistent. Consequently, the estimates will be inefficient and the OLS will give incorrect estimates of the parameter standard errors (Verbeek, 2008). To avoid this situation, the OLS is estimated using robust standard errors that ensure the residuals are independent of each other. Assumption (3) requires that the independent variables are not too strongly collinear. This is important because the problem of multicollinearity is an issue often raised in multiple regressions (regressions with more than one independent variable), since it prohibits accurate statistical inference. This condition occurs when there are near-linear relationships between the independent variables. To verify the validity of the hypothesis the Variance Inflation Factor (VIF) is calculated and presented – this indicator shows whether the variables are strongly collinear. If a VIF value is bigger than 10 there is strong collinearity between the variables.

Another problem that may arise when a multiple regression model is estimated is the existence of a misspecification of the model (a wrong specification of the model that may not properly represents the relationship between dependent and independent variables or the existence of omitted variables. Both may be causes for the occurrence of this problem). The Regression Specification Error Test or RESET test of Ramsey (1969), that became a standard test in applied research, tests the null hypothesis of the that the model is correctly specified. The test follows an F distribution - when the F-statistics is bigger than the critical value at a given significance level the null hypothesis of correct specification is rejected and, therefore, there is a functional form misspecification or omitted variables (Godfrey, 1991).

3. Empirical Results

The main results of empirical analysis are presented in this section. First, the results for the global sample (90 companies) are presented including the descriptive statistics and the results of OLS analysis. Second, the results for the industry sector samples are presented including the descriptive statistics and the results of OLS analysis. Finally, the results of OLS analysis of the global sample and sector samples are compared in order to find out how the independent variables affect the dependent variable (return on equity).

3.1. Results for the global sample (Nasdaq-100 NDX)

The following subsection presents the results of descriptive statistics and the results of OLS regression analysis for global sample.

3.1.1. Descriptive statistics

Before analyzing the results of OLS estimation both for global sample and sector samples, it is important to understand the indicators' distribution of values. To have a clear understanding about the indicators' distributions of values the descriptive statistics are presented and discussed. Indicators of central tendency, variability and shape are presented in Table 3.

Arithmetic mean is the indicator of central tendency, whereas the indicators of variability or dispersion around the mean are the minimum and maximum values in the sample, the range[3] (the difference between the minimum and maximum values of the distribution), the standard deviation and coefficient

[3] $Range = Maximum\ value - Minimum\ value$

of variation[4] (that gives the standard deviation in percentage values). The shape indicators are the skewness and kurtosis. Skewness is a measure of asymmetry around the variable's mean. Whereas, kurtosis measures how tall and sharp the central peak is relative to normal distribution.

The descriptive statistics indicators for the global sample are calculated using all the 90 observations (companies) which are presented in (Table 3).

Table 3. Statistical distribution of variables' values for the complete set of firms in the sample

Variable	Obs	Mean	Minimum	Maximum	Range	Standard Deviation	Coeficient of variation	Skewness	Kurtosis
ROE	90	22,29	-35,84	198,80	234,64	24,96	1,12	4,33	30,50
TB	90	74,99	13,97	164,90	150,92	19,22	0,26	0,58	8,24
IB	90	73,16	-1932,57	324,78	2257,35	216,24	2,96	-8,99	84,13
OM	90	18,65	-95,58	68,00	163,57	17,67	0,95	-2,84	21,54
AT	90	0,79	0,09	3,55	3,46	0,61	0,78	2,23	8,38
FL	90	2,57	1,11	11,97	10,86	1,59	0,62	3,44	18,48
PE	90	37,21	4,58	453,04	448,46	59,84	1,61	5,44	34,60
PB	90	5,61	1,03	40,30	39,28	5,18	0,92	3,91	24,35
CUR	90	2,41	0,14	11,25	11,10	1,77	0,74	2,20	10,02

Note: All the values are presented in the same unit of measurment of the variables with the exception of the coefficient of variation that is presented in %

Source: Author's calculations using Bloomberg data retrieved on 23.02.2016

The variables return on equity, interest burden, operating margin and price to earnings ratios are characterized by large deviations around their respective means. Due to this, the coefficient of variation, as well as range, present high values for these variables indicating a high degree of dispersion around their respective means. Moreover, those variables have also high skewness values meaning that their respective distributions are asymmetric. Return on equity and price to earnings are skewed to right as skewness values are positive meaning that most of the companies in the sample present values nearest to the minimum. Whereas, interest burden and operating margin are skewed to left as skewness values are negative meaning that most of the companies in the sample present values nearest to the maximum.

The second group of variables tax burden, asset turnover, financial leverage, price to book and current ratios have relatively low dispersion around their respective means indicated by lower values of their respective coefficient of variations and ranges compared with the first group. Kurtosis values of the second group are relatively lower compared to the first group of variables meaning that the distribution of variables of the former are less peaked (more dispersed) than the distributions of variables of the latter.

[4] $Coefficient\ of\ variation\ =\ Mean/\ Standard\ deviation * 100$

To sum up, return on equity, interest burden, operating margin and price to earnings variables are characterized by a significant degree of dispersion around their respective means compared to tax burden, asset turnover, financial leverage, price to book and current ratios as shown above by coefficient of variation, skewness and kurtosis values.

3.1.2 OLS regression analysis results for global sample

The OLS method is applied to identify and quantify which of the selected variables determine changes in the return on equity of the 90 companies of Nasdaq-100 NDX index selected for analysis. It allows also to verify the possible relation between each independent variable and the dependent variable – ROE.

As explained in the previous subsection 3.1, some variables are presented in percentage terms while others are presented in monetary units (€) which makes the comparison of each variable's impact on ROE difficult. For an obvious reason it is necessary to present them in a same unit of measure to simplify the comparison of results. Additionally, the descriptive statistical analysis showed that some variables exhibit high values of range (the distance between their minimum and maximum values were big). Therefore, the linear functional form of the model is transformed into a logarithmic functional form – all the variables will be used in their logarithmic format. Logarithmic values are known to decrease the degree of dispersion of a variable's values. Second, the transformation allows to analyze all the coefficients in percentage values. Thus, a second model using the same variables is estimated – the only difference between the first and the second model is that the former uses the values with original units of measure, whereas the latter uses logarithmic values. The second model is presented in equation 7:

$$LROE_i = \alpha + \beta_1 LTB_i + \beta_2 LIB_i + \beta_3 LOP_i + \beta_4 LAT_i + \beta_5 LFL_i + \beta_6 LPE_i + \beta_7 LPB_i + \beta_8 LCUR_i + \varepsilon_i \quad (7)$$

Due to presence of negative values in the dataset some observations are excluded from the second model. For each model the number of effective observations (companies) used is presented in OLS regression analysis.

Another important statistical indicator to present is the Pearson correlation coefficient between each explanatory/independent variable and the dependent variable the study wants to explain. The presentation of such an indicator allows to explore which independent variable may be positively or negatively related with the return on equity and the strength of such a relation. The results of the

Pearson correlation coefficient with statistical significance for both original values and logarithmic values are presented in Table 4. Results with no statistical significance are not present. The number of observations available for each variable is presented in brackets. According to table 4 tax burden, interest burden and price to book indicators are strongly correlated with return on equity. Whereas, Price to earnings ratio has a negative and strong association with return on equity and current ratio is not correlated with return on equity.

Table 4. Results of Pearson correlation coefficient between the independent variables and the return on equity

Variables		TB	IB	OM	AT	FL	PE	PB	CUR
Normal	ROE	0.411* (90)	-	0.346* (90)	-	0.554* (90)	- 0.212* (90)	0.177* (90)	-
Logarithmic	ROE	0.604* (88)	0.434* (87)	0.302* (87)	0.320* (88)	0.197 (88)	- 0.506* (88)	0.4061* (88)	-

Note: (*) means that the coefficient presents 5% level of significance. Values with no stars indicate 10% level of signficance. (-) indicates no relationship between the dependent and independent variable in question. Number of obervations available for analysis arepresented in brackets.

Source: Author's calculations using Bloomberg data retrieved on 23.02.2016

Table 5 presents the results of the regression analysis for all index constituents, using both the original measures (model 1) and the logarithmic values (model 2).

In the table, the first column presents the independent variables that may have influence on return on equity. The second column illustrates the estimated coefficients which reflect both the strength and type of relationship an independent variable has with a dependent variable, that is, if the changes in the independent variable make the return on equity change in the same direction[5]. The coefficients are given in the same measurement units as their associated independent variables and denote the expected change in dependent variable for every 1-unit change in the independent variable holding all other independent variables constant. The third column presents the robust standard error (that guarantees the hypothesis of homoscedasticity is not violated and therefore the results of the estimation are robust and trustworthy). The fourth column presents the p-values and the associated levels of statistical significance for each coefficient. Finally, the last column presents the VIF values that allow to conclude about collinearity between independent variables.

Indicators of the estimation quality and accuracy are also presented in the table which are the coefficient of determination (R-squared), the test of joint statistical significance (the F-test) and the root mean squared error (Root MSE). The results of the Ramsey test for omitted variables are also presented. N indicates the observations available to perform the estimation in each model.

The R-squared indicates how much of the variation that occurred in the return on equity are explained by the variation that happened in the independent variables. A value near to 1 indicates that the model explains all the variability of the response data around its mean. The F-test statistical significant indicates that the variables jointly create a good model. The smaller the Root MSE the more accurate is the estimation. The Ramsey test checks the existence of omitted variables. It indicates if the model includes the most important variables that explain the changes in the return on equity or, in other words, no important variable is omitted from the model.

As shown in Table 5, logarithmic values present better results as indicated by, for example, a higher R-squared value. Moreover, the regression analysis with original values presents a Ramsey values statistically significant which indicates the existence of omitted variables, that is, more variables should be added to the model to make the analysis more accurate.

The model presents a R-squared equal to 0,6786 for original values which means that almost 68% of the variation in the return on equity are explained by the variations that happen in the eight variables presented in the model. However, the results of regression analysis for logarithmic values indicate a much higher R-squared value - 93% of the variation in the return on equity is explained by changes in independent variables. For variables presented with their original measures and in logarithmic values, the remaining 38% and 7%, respectively, of the ROE variations are explained by the error term, that is,

[5] When the sign associated with coefficient is negative, the relationship is negative. Otherwise, the relationship is positive.

by factors like omitted variables, measurement errors or others that could not be included in the model. The F-test results for both normal and logarithmic values are statistical significant for a significance level of 1% which indicates that the independent variables jointly justify the variation on the return to equity. However, as explained before the Ramsey test indicates the existence of omitted variables if the original values are used. The R-squared and Root MSE values indicate that the results of logarithmic model (model 2) are better.

According to the results of regression analysis with normal values only CUR and IB (current, interest burden) are not statistically significant. The results of regression analysis with logarithmic values indicate that only CUR is not statistically significant. Therefore, a conclusion cannot be withdrawn regarding the influence of these variables on return on equity. All the other six variables for the first model and seven for the second model are statistically significant and present the expected sign between them and the return on equity.

The results of first model point out that asset turnover has a coefficient of 11.23 which means that 1€ change in asset turnover translates into 11.23% change in return on equity. Financial leverage has a value of 9.02 which signifies that 1€ change in financial leverage translates into 9% change return on equity. Nevertheless, the second model presents different results.

According to the results, tax burden, interest burden, operating margin, asset turnover, financial leverage ratios (extended DuPont components) describe changes occurring in return on equity. The coefficients of the second model for TB, IB, OM, AT and FL are 0.94, 0.95, 0.89, 0.90 and 0.89 respectively, which means that 1% change in TB, IB, OM, AT and FL translates into 0.94 %, 0.95 %, 0.89 %, 0.90 % and 0.89 % change in return on equity, respectively. The model asserts that TB, IB, OM, AT and FL (extended DuPont components) are the most powerful drivers of ROE.

Table 5. Results of the OLS regression analysis for all companies, using original measurement units and logarithmic values

	Model 1: Normal values					Model 2: Logarithmic values				
Variables	Estimated coefficient	Standard Robust Error	p-value		VIF	Estimated coefficient	Standard Robust Error	p-value		VIF
TB	0.44	0.154	0.005	***	1.24	0.94	0.034	0.000	***	1.47
IB	0.00	0.004	0.659		1.04	0.95	0.044	0.000	***	1.54
OM	0.59	0.273	0.033	**	1.32	0.89	0.047	0.000	***	4.32
AT	11.23	3.585	0.002	***	1.17	0.90	0.056	0.000	***	4.13
FL	9.02	3.047	0.004	***	1.41	0.89	0.064	0.000	***	3.59
PE	-0.06	0.030	0.040	**	1.55	-0.10	0.047	0.037	**	4.35
PB	0.63	0.207	0.003	***	1.37	0.14	0.066	0.042	**	4.24
CUR	1.83	1.249	0.147		1.31	-0.03	0.019	0.132		1.92
Constant	-59.43	19.489	0.003	***		-8.24	0.484	0.000	***	
	n=90					n=87				
	R-squared= 0.6786					R-squared= 0.9930				
	F-test (8, 81) = 5.55 ***					F-test (8, 78) = 4364.82 ***				
	Root MSE = 14.831					Root MSE = 0.06895				
	Ramsey test: F (3, 75) = 51.19 ***					Ramsey test: F (3, 75) = 0.44				

Notes: * means that the coefficient presents a 10% level of significance; ** means that the coefficient presents a 5% level of significance; *** means that the coefficient presents a 1% level of significance

Source: Author's calculations using Bloomberg data retrieved on 23.02.2016

3.2 The results for technology sector

The following subsection presents the results of descriptive statistics and the results of OLS regression analysis for Technology sector sample.

3.2.1 Descriptive statistics

The following table presents the same indicators of statistical distribution of table 3 with the difference that in this table firms only from the technology sector are considered.

Table 6. Statistical distribution of variables' values for the Technology sector sample

Variable	Obs	Mean	Minimum	Maximum	Range	Standard Deviation	Coefficient of variation	Skewness	Kurtosis
ROE	32	19.74	6.23	42.71	36.48	9.28	0.47	0.82	2.86
TB	32	81.64	65.50	116.84	51.34	11.86	0.15	0.98	3.77
IB	32	95.29	73.75	109.32	35.57	8.50	0.09	-0.86	3.19
OM	32	22.41	7.10	51.52	44.42	10.63	0.47	0.80	3.40
AT	32	0.64	0.31	1.24	0.93	0.22	0.34	0.69	3.17
FL	32	1.97	1.18	3.61	2.43	0.62	0.31	1.05	3.36
PE	32	24.08	6.53	71.64	65.11	12.30	0.51	1.92	8.31
PB	32	5.44	1.03	40.30	39.28	6.69	1.23	4.60	24.55
CUR	32	2.68	1.00	8.66	7.66	1.55	0.58	2.04	8.35

Note: All the values are presented in the same unit of measurment of the variables with the exception of the coefficient of variation that is presented in %

Source: Author's calculations using Bloomberg data retrieved on 23.02.2016

The variables can be divided into two groups. The first group of variables is characterized by high degree of dispersion which consists of return on equity, operating margin, price to earnings, price to book and current indicators given that there are large deviations around their respective means. This can be seen by the high values of coefficient of variations. Moreover, those variables have also high skewness values especially price to book and current ratios meaning that the distribution is asymmetric and skewed to the right. This means that most of the companies in the sample present values nearest to the minimum value. Kurtosis values are positive and high especially price to book indicating more peaked distribution relative to normal distribution.

The second group of variables includes tax burden, interest burden, asset turnover and financial leverage. In contrast to the first group, the second group is characterized by relatively low degree of dispersion given that there are relatively small deviations around their respective means. This is backed by low values of coefficient of variations. Compared to the first group, the second group exhibits lower values of skewness. Tax burden, asset turnover and financial leverage have positive

skewness values indicating that most of the companies again present values near to the minimum value. On the other hand, interest burden has a negative skewness meaning most of the companies present values near to the maximum value. Kurtosis values of the second group are relatively lower compared to the first group of variables meaning that the distribution of variables of the former are less peaked (more dispersed) than the distributions of variables of the latter.

Since Nasdaq-100 NDX presents largest companies in the world, companies operating in the same sector (Technology) have similar size and characteristics. It can be observed that variables are characterized by significantly less dispersion compared to the values of table 3. As the results of descriptive statistics in table 3 are for all companies from various industries, the variables exhibit notable dispersion around their respective means. This can be seen by comparing the coefficient of variations of table 6 and table 3.

3.2.2 OLS regression analysis results

The results of the Pearson correlation coefficient with statistical significance, for both original values and logarithmic values, are presented in Table 7. Results with no statistical significance are not presented. The number of observations available for each variable is presented in brackets. According to table 7 operating margin and price to book indicators are strongly correlated with return on equity. The asset turnover is also correlated with return on equity with 10% level of significance. The remaining indicators are not correlated with return on equity.

The results of OLS regression analysis for technology sample are presented in Table 8. As shown in Table 8, both models show high R-squared values indicating that variations occurring in the independent variables effectively explain variations occurring in the dependent variable. The first model presents a R-squared equal to 0,8621 for original values and the second model presents higher R-squared value of 0.9847. The results with logarithmic values are better due to higher R-squared value. The F-test results for both normal and logarithmic values are statistically significant for a significance level of 1%. The Root MSE is much lower for regression model using logarithmic values, indicating much higher accuracy compared to the model with normal values.

According to the results of regression analysis with normal values only PE and CUR (price to earnings, current ratio) are not statistically significant. The results of regression analysis with logarithmic values indicate that only CUR is not statistically significant. Therefore, a conclusion cannot be withdrawn regarding the influence of these variables on return on equity. All the other six variables for the first model and seven for the second model are statistically significant and present the expected sign between them and the return on equity.

The results of first model point out that asset turnover has a coefficient of 22.22 which means that 1€ change in asset turnover translates into 22.22% change in return on equity. Whereas, financial

leverage has a value of 6.95 which signifies that 1€ change in financial leverage translates into 6.95% change in return on equity. Nevertheless, the second model presents different results.

According to the results, tax burden, interest burden, operating margin, asset turnover, financial leverage ratios (extended DuPont components) have the most impact on return on equity. The coefficients of the second model for TB, IB, OM, AT and FL are 0.98, 0.54, 0.87, 0.87 and 0.71 respectively, which means that 1% change in TB, IB, OM, AT and FL translates into 0.98 %, 0.54 %, 0.87 %, 0.87 % and 0.71 % change in return on equity, respectively. The model asserts that TB, IB, OM, AT and FL (extended DuPont components) are the most powerful drivers of ROE.

Table 7. Results of Pearson correlation coefficient between the independent variables and the return on equity

Variables		TB	IB	OM	AT	FL	PE	PB	CUR
Normal	ROE	-	-	0.542* (32)	0.334 (32)	0.334 (32)	-	0.425* (32)	-
Logarithmic	ROE	-	-	0.542* (32)	0.326 (32)	-	-	0.471* (32)	-

Note: (*) means that the coefficient presents 5% level of significance. Values with no stars indicate 10% level of signficance. (-) indicates no relationship between the dependent and independent variable in question. Number of obervations available for analysis arepresented in brackets.

Source: Author's calculations using Bloomberg data retrieved on 23.02.2016

Table 8. Results of the OLS regression analysis for the technology sector sample, using original measurement units and logarithmic values

	Model 1: Normal values					Model 2: Logarithmic values				
Variables	Estimated coefficient	Standard Robust Error	p-value		VIF	Estimated coefficient	Standard Robust Error	p-value		VIF
TB	0.13	0.066	0.066	*	2	0.98	0.149	0.000	***	2.25
IB	0.21	0.106	0.065	*	2.2	0.54	0.248	0.041	***	2.5
OM	0.67	0.126	0.000	***	1.46	0.87	0.056	0.000	***	2.2
AT	22.22	5.403	0.000	***	1.68	0.87	0.058	0.000	***	3.04
FL	6.95	1.456	0.000	***	1.79	0.71	0.128	0.000	***	3.26
PE	-0.01	0.034	0.723		1.94	-0.13	0.071	0.090	**	4.03
PB	0.39	0.081	0.000	***	1.56	0.20	0.079	0.020	**	4.28
CUR	-0.13	0.680	0.845		1.41	-0.05	0.033	0.180		1.72
Constant	-54.72	13.621	0.001	***		-6.33	1.577	0.001	***	
	n = 32					n=32				
	R-squared = 0.8621					R-squared= 0.9847				
	F-Test (8, 23) = 126.97 ***					F-test (8, 23) = 1009.39 ***				
	Root MSE = 3.9997					Root MSE = 0.06749				
	Ramsey test: F (3, 20) = 0.28					Ramsey test: F (3, 20) = 0.19				

Notes: * means that the coefficient presents a 10% level of significance; ** means that the coefficient presents a 5% level of significance; *** means that the coefficient presents a 1% level of significance

Source: Author's calculations using Bloomberg data retrieved on 23.02.2016

3.3 The results for consumer sector

The following subsection presents the results of descriptive statistics and the results of OLS regression analysis for Consumer sector sample.

3.3.1 Descriptive statistics

The following table presents the same indicators of statistical distribution of table 3 with the difference that in this table firms only from the consumer sector are considered.

Table 9. Statistical distribution of variables' values for the Consumer sector sample

Variable	Obs	Mean	Minimum	Maximum	Range	Stdandard Deviation	Coefficient of variation	Skewness	Kurtosis
ROE	34	29.00	-35.84	198.80	234.64	37.12	1.28	3.04	14.62
TB	34	73.41	28.98	164.90	135.91	22.66	0.31	1.68	9.43
IB	34	93.90	42.70	154.03	111.33	18.45	0.20	-0.11	6.47
OM	34	18.39	-28.56	68.00	96.55	15.90	0.86	0.34	5.89
AT	34	1.11	0.22	3.55	3.34	0.85	0.76	1.10	3.48
FL	34	2.79	1.15	11.97	10.82	1.91	0.68	3.49	17.12
PE	34	28.69	4.58	72.15	67.58	14.69	0.51	0.89	3.83
PB	34	6.01	1.61	14.31	12.70	3.74	0.62	0.88	2.61
CUR	34	2.15	0.14	6.97	6.82	1.54	0.71	1.21	4.10

Note: All the values are presented in the same unit of measurment of the variables with the exception of the coefficient of variation that is presented in %

Source: Author's calculations using Bloomberg data retrieved on 23.02.2016

The variables can be divided into two groups. The first group of variables is characterized by high degree of dispersion which consists of return on equity, operating margin, asset turnover, financial leverage and current ratios given that there are large deviations around their respective means. This can be seen by the high values of coefficient of variations. Moreover, those variables have also high skewness values especially return on equity and financial leverage meaning that most of the companies in the sample present values nearest to the minimum. Kurtosis values are positive and high especially return on equity and financial leverage indicating more peaked distribution relative to normal distribution.

The second group of variables includes tax burden, interest burden, price to earnings and price to book. In contrast to the first group, the second group is characterized by relatively low degree of dispersion given that there are relatively small deviations around their respective means. This is based on low values of coefficient of variations. Tax burden, price to earnings and price to book have positive skewness values indicating that most of the companies in the sample present values nearest to the

minimum. On the other hand, interest burden has a negative skewness meaning that most of the companies in the sample present values nearest to the maximum. Kurtosis values of the second group are relatively lower compared to the first group of variables meaning that the distribution of variables of the former are less peaked (more dispersed) than the distributions of variables of the latter.

Since all the companies operate in Consumer sector, it can be observed that variables are characterized by significantly less dispersion compared to the values of table 3 as was the case for Technology sector. This can be seen by comparing the coefficient of variations of table 9 and table 3.

3.3.2 OLS regression analysis results

The results of the Pearson correlation coefficient with statistical significance, for both original values and logarithmic values, are presented in Table 10. Results with no statistical significance are not presented. The number of observations available for each variable is presented in brackets.

According to table 10 tax burden and price to book and price to earnings indicators have the highest impact on return on equity. Whereas, interest burden, operating margin and financial leverage have relatively low impact on return on equity. It is noteworthy that price to earnings ratio has a negative association with return on equity. According to table 10, asset turnover and current ratios have no impact on return on equity.

Table 10. Results of Pearson correlation coefficient between the independent variables and the return on equity

Variables		TB	IB	OM	AT	FL	PE	PB	CUR
Normal	ROE	0.578* (34)	-	0.410* (34)	-	0.718* (34)	-0.406* (34)	-	-
Logarithmic	ROE	0.672* (33)	0.327 (33)	0.293 (33)	-	0.404* (33)	-0.548* (33)	0.525* (33)	-

Note: (*) means that the coefficient presents 5% level of significance. Values with no stars indicate 10% level of signficance. (-) indicates no relationship between the dependent and independent variable in question. Number of obervations available for analysis arepresented in brackets.

Source: Author's calculations using Bloomberg data retrieved on 23.02.2016

The results of OLS regression analysis for technology sample are presented in Table 11. As shown in Table 11, both models show high R-squared values indicating that variations occurring in the independent variables effectively explain variations occurring in the dependent variable. The first model presents a R-squared equal to 0,9022 for original values and the second model presents higher R-squared value of 0.9934. Obviously, second model with logarithmic values is better due to higher R-squared value. The F-test results for both normal and logarithmic values are statistically significant for a significance level of 1%. The Root MSE is much lower for regression model using logarithmic values, indicating much higher accuracy compared to the model with normal values.

It is noteworthy that the regression analysis with original values presents a Ramsey values statistically significant which indicates the existence of omitted variables, that is, that more variables should be added to the model to make the analysis more accurate.

According to the results of regression analysis with normal values TB, IB, PE, PB, CUR (tax burden, interest burden, price to earnings, price to book and current) are not statistically significant. The results of regression analysis with logarithmic values indicate that PE, PB, CUR are not statistically significant. Therefore, a conclusion cannot be withdrawn regarding the influence of these variables on return on equity. OM, AT and FL (DuPont components) variables for the first model and TB, IB, OM, AT, FL (extended DuPont components) for the second model are statistically significant and present the expected sign between them and the return on equity.

The results of first model point out that operating margin has a coefficient of 1.47 which means that 1% change in operating margin results in 1.47% change in return on equity. Asset turnover has a coefficient of 18.48 which means that 1€ change in asset turnover translates into 18.48% change in return on equity. Financial leverage has a value of 14.96 which signifies that 1€ change in financial leverage translates into 14.96% change in return on equity. Nevertheless, the second model presents different results.

According to the results, tax burden, interest burden, operating margin, asset turnover, financial leverage ratios (extended DuPont components) significantly affect return on equity. The coefficients of the second model for TB, IB, OM, AT and FL are 0.91, 1.05, 0.87, 0.88 and 0.93 respectively, which means that 1% change in TB, IB, OM and 1€ change in AT and FL translates into 0.91 %, 1.05 %, 0.87 %, 0.88 % and 0.93 % change in return on equity, respectively. The model asserts that TB, IB, OM, AT and FL (extended DuPont components) are the most powerful drivers of ROE which was the case both in global and technology samples.

Table 11. Results of the OLS regression analysis for the consumer sector sample, using original measurement units and logarithmic values

	Model 1: Normal values					Model 2: Logarithmic values				
Variables	Estimated coefficient	Standard Robust Error	p-value		VIF	Estimated coefficient	Standard Robust Error	p-value		VIF
TB	0.25	0.185	0.193		2.71	0.91	0.079	0.000	***	1.89
IB	0.07	0.124	0.555		1.28	1.05	0.064	0.000	***	1.63
OM	1.47	0.221	0.000	***	2.28	0.87	0.079	0.000	***	7.3
AT	18.48	6.268	0.007	***	1.91	0.88	0.094	0.000	***	9.01
FL	14.96	2.876	0.000	***	2.77	0.93	0.057	0.000	***	6.28
PE	0.00	0.284	0.990		2.75	-0.12	0.081	0.149		6.25
PB	0.09	1.086	0.936		2.05	0.12	0.092	0.196		6.78
CUR	0.54	1.863	0.775		1.79	-0.01	0.015	0.538		1.87
Constant	-86.91	25.759	0.002	***		-8.45	0.749	0.000	***	
	n = 34					n=33				
	R-squared = 0.9022					R-squared= 0.9934				
	F-Test (8, 25) = 25.48 ***					F-test (8, 24) = 1082.18 ***				
	Root MSE = 13.339					Root MSE = 0.0805				
	Ramsey test: F (3, 22) = 98.97***					Ramsey test: F (3, 21) = 1.82				

Notes: * means that the coefficient presents a 10% level of significance; ** means that the coefficient presents a 5% level of significance; *** means that the coefficient presents a 1% level of significance

Source: Author's calculations using Bloomberg data retrieved on 23.02.2016

3.4 Results for other sector

The following subsection presents the results of descriptive statistics and the results of OLS regression analysis for other sectors sample.

3.4.1 Descriptive statistics

The following table presents the same indicators of statistical distribution of table 3 with the difference that in this table firms only from other (residual) sector are considered.

Table 12. Statistical distribution of variables' values for the other sectors sample

Variable	Obs	Mean	Minimum	Maximum	Range	Standard Deviation	Coefficient of variation	Skewness	Kurtosis
ROE	24	16.18	-12.86	53.08	65.94	14.25	0.88	1.01	4.68
TB	24	68.38	13.97	97.63	83.66	19.81	0.29	-0.85	3.52
IB	24	14.29	-1932.57	324.78	2257.35	418.83	29.30	-4.43	21.20
OM	24	14.00	-95.58	35.33	130.91	25.51	1.82	-3.43	15.51
AT	24	0.53	0.09	1.78	1.69	0.31	0.59	2.72	12.43
FL	24	3.08	1.11	9.44	8.32	1.79	0.58	2.08	7.85
PE	24	66.77	7.50	453.04	445.54	109.92	1.65	2.61	8.80
PB	24	5.28	1.11	19.82	18.71	4.79	0.91	2.11	6.79
CUR	24	2.40	0.25	11.25	11.00	2.31	0.96	2.57	10.20

Note: All the values are presented in the same unit of measurment of the variables with the exception of the coefficient of variation that is presented in %

Source: Author's calculations using Bloomberg data retrieved on 23.02.2016

Table 12 consists of 24 observations regarding companies from different sectors, excluding technology and consumer sectors which are gathered in a residual sector named "other sectors". Since the observations are from different sectors, it can be observed that there are some major differences between the values of table 12 and table 9, table 6.

The degree of dispersion is similar to Technology and Consumer sector. However, tax burden, interest burden and operating margin have negative values indicating that most of the companies in the sample present values nearest to the minimum which was not the case in Technology and Consumer sectors as only interest burden had a negative skewness value. Kurtosis values are much higher in other sectors compared to consumer and technology sectors except return on equity and tax burden meaning that the distribution of variables of the former are less peaked (more dispersed) than the distributions of variables of the latter. These differences are obvious as grouping of companies from different sectors results in scattered values due to different characteristics present in different industries.

3.4.2 OLS regression analysis results

The results of the Pearson correlation coefficient with statistical significance, for both original values and logarithmic values, are presented in Table 13. Results with no statistical significance are not presented. The number of observations available for each variable is presented in brackets.

According to table 13 tax burden, interest burden and price to earnings indicators are strongly correlated with return on equity. It is noteworthy that price to earnings ratio has a negative association with return on equity. Whereas, operating margin, asset turnover, financial leverage, price to book and current ratios are not correlated with return on equity.

The results of OLS regression analysis for other sample are presented in Table 14. As shown in Table 14, both models show high R-squared values indicating that variations occurring in the independent variables effectively explain variations occurring in the dependent variable. The first model presents a R-squared equal to 0,6204 for original values and the second model presents higher R-squared value of 0.9998. Obviously, the second model with logarithmic values is better due to higher R-squared value. The F-test results for both normal and logarithmic values are statistically significant for a significance level of 1%. The Root MSE is much lower for regression model using logarithmic values, indicating much higher accuracy compared to the model with normal values. However, there is a problem regarding the VIF values in some variables. Therefore, the results of other sector should be considered with caution.

Moreover, the regression analysis with original values presents a Ramsey values statistically significant which indicates the existence of omitted variables, that is, that more variables should be added to the model to make the analysis more accurate.

According to the results of regression analysis with normal values none of the variables are statistically significant. A conclusion cannot be withdrawn regarding the influence of these variables on return on equity. TB, IB, OM, AT, FL (extended DuPont components) for the second model are statistically significant and present the expected sign between them and the return on equity. According to the results, tax burden, interest burden, operating margin, asset turnover and financial leverage ratios (extended DuPont components) significantly affect return on equity.

The coefficients of the second model for TB, IB, OM, AT and FL are 1, 1.01, 1.02, 1 and 1.02 respectively, which means that 1% change in TB, IB, OM and 1% change in AT and FL translates into 1 %, 1.01 %, 1.02 %, 1 % and 1.02 % change in return on equity, respectively. The model asserts that TB, IB, OM, AT and FL (extended DuPont components) are the most powerful drivers of ROE.

As shown in table 5, 8, 11 and 14 TB, IM, OM, AT and FL are statistically significant in every sample which is one of the most important findings of this study. The coefficients of these variables are relatively similar in each sample which highlights the importance of extended DuPont model as a determinant of return on equity. Those variables almost equally affect return on equity in each sample.

Table 13. Results of Pearson correlation coefficient between the independent variables and the return on equity

Variables		TB	IB	OM	AT	FL	PE	PB	CUR
Normal	ROE	-	-	0.433* (24)	-	-	-0.416* (24)	-	-
Logarithmic	ROE	0.749* (23)	0.635* (22)	-	-	-	-0.590* (23)	-	-

Note: (*) means that the coefficient presents 5% level of significance. Values with no stars indicate 10% level of signficance. (-) indicates no relationship between the dependent and independent variable in question. Number of obervations available for analysis arepresented in brackets.

Source: Author's calculations using Bloomberg data retrieved on 23.02.2016

Table 14. Results of the OLS regression analysis for the other sector sample, using original measurement units and logarithmic values

	Model 1: Normal values				Model 2: Logarithmic values				
Variables	Estimated coefficient	Standard Robust Error	p-value		VIF	Estimated coefficient	Standard Robust Error	p-value		VIF
TB	0.23	0.193	0.261		2.52	1.00	0.009	0.000	***	2.84
IB	0.00	0.007	0.691		1.7	1.01	0.008	0.000	***	2.51
OM	0.12	0.206	0.584		4.81	1.02	0.015	0.000	***	11.1
AT	7.00	10.615	0.520		3.93	1.00	0.015	0.000	***	6.90
FL	2.28	3.103	0.475		2.48	1.02	0.020	0.000	***	8.32
PE	-0.10	0.095	0.302		14.91	0.01	0.009	0.267		13.66
PB	1.26	2.308	0.592		14.6	0.00	0.013	0.922		9.90
CUR	-0.24	0.929	0.803		1.67	0.00	0.007	0.985		4.72
Constant	-10.92	20.171	0.596			-9.39	0.121	0.000	***	
	n = 24					n=22				
	R-squared = 0.6204					R-squared= 0.9998				
	F-Test (8, 15) = 11.64 ***					F-test (8, 13) = 49663.91 ***				
	Root MSE = 10.868					Root MSE = 0.0165				
	Ramsey test: F (3, 12) = 5.32**					Ramsey test: F (3, 21) = 2.13				

Source: Author's calculations using Bloomberg data retrieved on 23.02.2016

3.5 Comparative analysis of global and sector samples

The following subsection compares the results of OLS regression analysis of global and sector samples. It aims to draw conclusions regarding the impact of independent variables on return on equity by making comparisons among the samples. Along with such comparisons the results are also compared to other studies. The most important finding of this study evidenced by OLS regression analysis is that extended DuPont components, namely tax burden, interest burden, operating margin, asset turnover and financial leverage are the most powerful drivers of return on equity independent of sector. This finding indicates that variations occurring in extended DuPont components effectively explain the variations occurring in return on equity.

Very little empirical research is found on extended DuPont components that affect return on equity for comparison purposes. Moreover, research on return on equity drivers in consumer and technology industries is also rare which hinders the process of comparison of industries. However, there is plenty of research regarding the impact of DuPont components, namely asset turnover, profit margin and financial leverage on return on equity for different sectors.

Mubin et al., (2014) assert that asset turnover is the most influential factor among DuPont components. Financial leverage has a moderate impact on return on equity, whereas, operating margin has no effect on return on equity. Only asset turnover and financial leverage can be compared to our results as due to the decomposition of DuPont model operating margin is used in our study instead of profit margin. As shown in table 15, asset turnover and financial leverage and operating margin are statistically significant in all samples. The difference between the results is that the coefficients in every sample regarding asset turnover, financial leverage and operating margin are relatively similar as shown in table 15, whereas Mubin et al., (2014) concluded that asset turnover has the highest impact on return on equity followed by moderate impact of financial leverage and absence of impact of profit margin. Price to earnings and price to book indicators are statistically significant only in global and technology samples. The underlying reason may be the strong sensitivity of price to earnings and price to book ratios to industries. Therefore, their impact on return on equity is dependent on industry.

Saleem and Rehman (2011) were among the first who attempted to identify an empirical relationship between liquidity (current, quick and liquid ratios) and profitability (return on assets, return on equity, return on investment ratios) measures. According to their results, return on equity is not significantly affected by current ratio. As shown in table 15, no statistically significant relationship is found between current and return on equity ratios in any sample.

Burja et al., (2014) concluded that there is a strong correlation between return on equity net income, return on assets, operating profit, asset turnover and financial leverage in furniture industry. Operating

margin, asset turnover and financial leverage variables (DuPont components) are used in our study and as mentioned before these variables are statistically significant independent of industry. However, the comparison of results is complicated as the authors used Pearson correlation in their analysis and this study uses OLS regression analysis.

Table 15. Comparative analysis of OLS regression results

	Nasdaq-100 componnets			Technology sector			Consumer sector			Other sectors		
Variables	Estimated coefficient	p-value		Estimated coefficient	p-value		Estimated coefficient	p-value		Estimated coefficient	p-value	
TB	0.94	0.000	***	0.98	0.000	***	0.91	0.000	***	1.00	0.000	***
IB	0.95	0.000	***	0.54	0.041	***	1.05	0.000	***	1.01	0.000	***
OM	0.89	0.000	***	0.87	0.000	***	0.87	0.000	***	1.02	0.000	***
AT	0.90	0.000	***	0.87	0.000	***	0.88	0.000	***	1.00	0.000	***
FL	0.89	0.000	***	0.71	0.000	***	0.93	0.000	***	1.02	0.000	***
PE	-0.10	0.037	**	-0.13	0.090	**	-0.12	0.149		0.01	0.267	
PB	0.14	0.042	**	0.20	0.020	**	0.12	0.196		0.00	0.922	
CUR	-0.03	0.132		-0.05	0.180		-0.01	0.538		0.00	0.985	
Constant	-8.24	0.000	***	-6.33	0.001	***	-8.45	0.000	***	-9.39	0.000	***

Source: Author’s calculations using Bloomberg data retrieved on 23.02.2016

Conclusions, Limitations and Future Research directions

The thesis investigates prominent ratios and indicators that determine return on equity. The study incorporates a set of ratios/indicators that may have impact on return on equity. As mentioned throughout the thesis, profitability analysis plays a crucial role in financial statement analysis and return on equity (profitability measure) is an important metric for a company manager who attempts to understand company's strengths and weaknesses or an investor who seeks a profitable investment. Any market participant practically uses profitability measures no matter the underlying reason of financial analysis in question. In this respect, return on equity assumes a greater relevance as it measures how effectively capital is utilized to generate profit for company's shareholders. Therefore, it is imperative to identify the determinants of return on equity, in other words, ratios and indicators that have the most explanatory power regarding return on equity. Considering the literature review, the study incorporates eight ratios/indicators that may have impact on return on equity.

To carry out the empirical analysis, OLS regression analysis is used on Nasdaq-100 NDX components and three industry sectors. Two models are used for the empirical analysis. The first model uses original units of measure. Whereas, the second model uses logarithmic values. The results of the second model are better not only for the global sample but also industry sector samples as in all cases the second model shows higher value of R-squared compared to the first model. Furthermore, the first model presented Ramsey test value statistically significant in every sample except technology which renders the results of the model inaccurate. Therefore, only the results of the second model are considered.

According to the findings for global sample, the coefficients of the second model for TB, IB, OM, AT and FL, PE and PB are 0.94, 0.95, 0.89, 0.90, 0.89, -0.10 and 0.14 respectively, which means that 1% change in TB, IB, OM, AT, FL, PE and PB translates into 0.94 %, 0.95 %, 0.89 %, 0.90 % and 0.89 %, -0.10% and 0.14% change in return on equity, respectively. The model asserts that TB, IB, OM, AT and FL (extended DuPont components) are the most powerful drivers of ROE.

According to the findings for technology sample, the coefficients of the second model for TB, IB, OM, AT, FL, PE and PB are 0.98, 0.54, 0.87, 0.87, 0.71, -0.13 and 0.20 respectively, which means that 1% change in TB, IB, OM, AT and FL translates into 0.98 %, 0.54 %, 0.87 %, 0.87 % and 0.71 % change in return on equity, respectively. The model asserts that TB, IB, OM, AT and FL (extended DuPont components) are the most powerful drivers of ROE. Thus, the most important drivers of return on equity are extended DuPont components. The current ratio is not statistically significant.

According to the findings for consumer sample, the coefficients of the second model for TB, IB, OM, AT and FL are 0.91, 1.05, 0.87, 0.88 and 0.93 respectively, which means that 1% change in TB, IB, OM and 1€ change in AT and FL translates into 0.91 %, 1.05 %, 0.87 %, 0.88 % and 0.93 % change in return on equity, respectively. Thus, the most important drivers of return on equity are extended

DuPont components. Price to earnings and price to book and current ratios are not statistically significant

According to the findings for other sample, the coefficients of the second model for TB, IB, OM, AT and FL are 1.00, 1.01, 1.02, 1.00 and 1.02 respectively, which means that 1% change in TB, IB, OM and 1€ change in AT and FL translates into 1 %, 1.01 %, 1.02 %, 1 % and 1.02 % change in return on equity, respectively. Thus, the most important drivers of return on equity are extended DuPont components. Price to earnings and price to book and current ratios are not statistically significant

The most important finding of this study is that extended DuPont components are the most powerful drivers of return on equity. It is important to highlight the fact that this result is achieved in each sample from which a conclusion of significant importance can be drawn. The extended DuPont components have enough explanatory power to describe the variations occurring in return on equity regardless of the industry sector. Therefore, extended DuPont analysis can be considered as a very sophisticated tool for ratio analysis. By solely making extended DuPont analysis a market participant is equipped to observe the changes in the components, which in turn change return on equity. According to the findings, extended DuPont analysis provides important insights into the changes in return on equity. This finding is unique on its own and this is one of the newest empirical studies trying to identify return on equity drivers by incorporating extended DuPont components.

The price to earnings ratio and price to book ratios were only statistically significant in global and technology samples. However, they were not statistically significant in consumer and other sample. The underlying reason could be intra-sector wide dispersion of ROE and other indicators in consumer sector. Even though Consumer sector companies operate in the same sector their nature of operations and business model varies. Technology sector is more homogeneous and low dispersion can be observed in values of variables.

Current ratio is statistically insignificant in all samples. Therefore, conclusions cannot be withdrawn regarding its impact on return on equity. Saleem et al., (2011) have also found that current ratio does not affect return on equity.

The main limitation of this study is that the research sample is limited to Nasdaq-100 NDX components. Another limitation is that the empirical analysis was carried out only for two industry sectors. Based on the results of this study, it has been concluded that extended DuPont components are the most powerful drivers of return on equity. This finding can be further studied by making research:

- on larger samples extending the analysis from Nasdaq-100 NDX to larger indexes,
- by extending the scope to more industry sectors,
- based on time series and cross sectional data to find out which ratios/indicators have the most explanatory power on return on equity over time. This would allow to identify predictive power of those indicators to forecast changes in return on equity.

Extensive research based on time series with DuPont components is found in literature. According to Penman (1991) “a further research question is whether (and how) a decomposition of ROE might improve the assessment of future profitability.” Such research using three-step DuPont components is ample in literature, however research that decomposes DuPont components into five-step DuPont model to assess future profitability is not found. Thus, extended DuPont model could be used in time series to continue previous research as it allows to more deeply dive into the components affecting return on equity.

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Appendix 1. Index constituents for Nasdaq-100 NDX

Table 16. Global sector companies

Index constituents	
Company Name	**Industry sector**
Yahoo! Inc	Communications
Maxim Integrated Products Inc	Technology
Norwegian Cruise Line Holdings Ltd	Consumer, Cyclical
Mondelez International Inc	Consumer, Non-cyclical
Stericycle Inc	Industrial
Tractor Supply Co	Consumer, Cyclical
DISH Network Corp	Communications
Amazon.com Inc	Communications
Alexion Pharmaceuticals Inc	Consumer, Non-cyclical
Endo International PLC	Consumer, Non-cyclical
Cisco Systems Inc	Communications
Intel Corp	Technology
Microsoft Corp	Technology
NVIDIA Corp	Technology
Cognizant Technology Solutions Corp	Technology
Intuitive Surgical Inc	Consumer, Non-cyclical
eBay Inc	Communications
Priceline Group Inc/The	Communications
Illumina Inc	Consumer, Non-cyclical
Akamai Technologies Inc	Technology
Texas Instruments Inc	Technology
Kraft Heinz Co/The	Consumer, Non-cyclical
Alphabet Inc	Communications
Netflix Inc	Communications
Western Digital Corp	Technology
Automatic Data Processing Inc	Consumer, Non-cyclical
Walgreens Boots Alliance Inc	Consumer, Cyclical
Seagate Technology PLC	Technology
Adobe Systems Inc	Technology
Amgen Inc	Consumer, Non-cyclical
CSX Corp	Industrial
Apple Inc	Technology
Discovery Communications Inc	Communications

Comcast Corp	Communications
Broadcom Ltd	Technology
CA Inc	Technology
PACCAR Inc	Consumer, Cyclical
Liberty Interactive Corp QVC Group	Consumer, Cyclical
Costco Wholesale Corp	Consumer, Cyclical
Regeneron Pharmaceuticals Inc	Consumer, Non-cyclical
Skyworks Solutions Inc	Technology
Activision Blizzard Inc	Technology
Applied Materials Inc	Technology
Bed Bath & Beyond Inc	Consumer, Cyclical
Celgene Corp	Consumer, Non-cyclical
Expedia Inc	Communications
Cerner Corp	Technology
Discovery Communications Inc	Communications
American Airlines Group Inc	Consumer, Cyclical
Viacom Inc	Communications
Twenty-First Century Fox Inc	Communications
Electronic Arts Inc	Technology
Express Scripts Holding Co	Consumer, Non-cyclical
Ulta Salon Cosmetics & Fragrance Inc	Consumer, Cyclical
Fastenal Co	Consumer, Cyclical
Henry Schein Inc	Consumer, Non-cyclical
TripAdvisor Inc	Communications
Fiserv Inc	Technology
Facebook Inc	Communications
Gilead Sciences Inc	Consumer, Non-cyclical
Biogen Inc	Consumer, Non-cyclical
Lam Research Corp	Technology
Linear Technology Corp	Technology
Paychex Inc	Technology
Analog Devices Inc	Technology
PayPal Holdings Inc	Consumer, Non-cyclical
QUALCOMM Inc	Technology
Ross Stores Inc	Consumer, Cyclical
Starbucks Corp	Consumer, Cyclical
Symantec Corp	Communications
Whole Foods Market Inc	Consumer, Non-cyclical
Xilinx Inc	Technology
Liberty Media Corp	Communications
Intuit Inc	Technology
Monster Beverage Corp	Consumer, Non-cyclical
O'Reilly Automotive Inc	Consumer, Cyclical

Check Point Software Technologies Ltd	Technology
Ctrip.com International Ltd	Communications
NXP Semiconductors NV	Technology
Mattel Inc	Consumer, Cyclical
Micron Technology Inc	Technology
Baidu Inc	Communications
Mylan NV	Consumer, Non-cyclical
T-Mobile US Inc	Communications
Verisk Analytics Inc	Consumer, Non-cyclical
Dollar Tree Inc	Consumer, Cyclical
Twenty-First Century Fox Inc	Communications
SanDisk Corp	Technology
NetApp Inc	Technology
Citrix Systems Inc	Technology

Source: Retrieved from http://www.nasdaq.com/quotes/nasdaq-100-stocks.aspx

Appendix 2. Nasdax-100 NDX constituents by industry sector

Table 17. Technology sector companies

Index constituents by industry sector	
Company Name	**Sector name**
Maxim Integrated Products Inc	Technology
Intel Corp	Technology
Microsoft Corp	Technology
NVIDIA Corp	Technology
Cognizant Technology Solutions Corp	Technology
Akamai Technologies Inc	Technology
Texas Instruments Inc	Technology
Western Digital Corp	Technology
Seagate Technology PLC	Technology
Adobe Systems Inc	Technology
Apple Inc	Technology
Broadcom Ltd	Technology
CA Inc	Technology
Skyworks Solutions Inc	Technology
Activision Blizzard Inc	Technology
Applied Materials Inc	Technology
Cerner Corp	Technology
Electronic Arts Inc	Technology
Fiserv Inc	Technology
Lam Research Corp	Technology
Linear Technology Corp	Technology
Paychex Inc	Technology
Analog Devices Inc	Technology
QUALCOMM Inc	Technology
Xilinx Inc	Technology
Intuit Inc	Technology
Check Point Software Technologies Ltd	Technology
NXP Semiconductors NV	Technology
Micron Technology Inc	Technology
SanDisk Corp	Technology
NetApp Inc	Technology
Citrix Systems Inc	Technology

Source: Retrieved from http://www.nasdaq.com/quotes/nasdaq-100-stocks.aspx

Table 18. Consumer sector companies

Index constituents by industry sector	
Company Name	**Sector name**
Norwegian Cruise Line Holdings Ltd	Consumer
Mondelez International Inc	Consumer
Tractor Supply Co	Consumer
Alexion Pharmaceuticals Inc	Consumer
Endo International PLC	Consumer
Intuitive Surgical Inc	Consumer
Illumina Inc	Consumer
Kraft Heinz Co/The	Consumer
Automatic Data Processing Inc	Consumer
Walgreens Boots Alliance Inc	Consumer
Amgen Inc	Consumer
PACCAR Inc	Consumer
Liberty Interactive Corp QVC Group	Consumer
Costco Wholesale Corp	Consumer
Regeneron Pharmaceuticals Inc	Consumer
Bed Bath & Beyond Inc	Consumer
Celgene Corp	Consumer
American Airlines Group Inc	Consumer
Express Scripts Holding Co	Consumer
Ulta Salon Cosmetics & Fragrance Inc	Consumer
Fastenal Co	Consumer
Henry Schein Inc	Consumer
Gilead Sciences Inc	Consumer
Biogen Inc	Consumer
PayPal Holdings Inc	Consumer
Ross Stores Inc	Consumer
Starbucks Corp	Consumer
Whole Foods Market Inc	Consumer
Monster Beverage Corp	Consumer
O'Reilly Automotive Inc	Consumer
Mattel Inc	Consumer
Mylan NV	Consumer
Verisk Analytics Inc	Consumer
Dollar Tree Inc	Consumer

Source: Retrieved from http://www.nasdaq.com/quotes/nasdaq-100-stocks.aspx

Table 19. Other sectors companies

Index constituents by industry sector	
Company Name	**Sector name**
Yahoo! Inc	Communications
Stericycle Inc	Industrial
DISH Network Corp	Communications
Amazon.com Inc	Communications
Cisco Systems Inc	Communications
eBay Inc	Communications
Priceline Group Inc/The	Communications
Alphabet Inc	Communications
Netflix Inc	Communications
CSX Corp	Industrial
Discovery Communications Inc	Communications
Comcast Corp	Communications
Expedia Inc	Communications
Discovery Communications Inc	Communications
Viacom Inc	Communications
Twenty-First Century Fox Inc	Communications
TripAdvisor Inc	Communications
Facebook Inc	Communications
Symantec Corp	Communications
Liberty Media Corp	Communications
Ctrip.com International Ltd	Communications
Baidu Inc	Communications
T-Mobile US Inc	Communications
Twenty-First Century Fox Inc	Communications

Source: Retrieved from http://www.nasdaq.com/quotes/nasdaq-100-stocks.aspx