

Financial ratios and indicators that determine return on equity

Davit Kharatyan

Instituto Politécnico de Bragança; National Polytechnic University of Armenia.

e-mail: davidkharatyan94@yahoo.com

Alcina Nunes

Instituto Politécnico de Bragança

Campus de Santa Apolonia - Apartado 1134; Código Postal: 5301 854 Bragança

e-mail: alcina@ipb.pt

Tel. 00.351.273.303.108

José Carlos Lopes

Instituto Politécnico de Bragança

Campus de Santa Apolonia - Apartado 1134; Código Postal: 5301 854 Bragança

e-mail: jlopes@ipb.pt

Tel. 00.351.273.303.108

Categories: A) •Finance and Valuation

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

Financial ratios and indicators that determine return on equity

Abstract

This study aims to investigate factors that affect return on equity (ROE). Firms with higher ROE typically have competitive advantages over their competitors which translates into superior returns for investors. Therefore, it seems imperative to study the drivers of ROE, particularly financial ratios/indicators that may have considerable impact on it. The analysis is done on a sample of 90 non-financial companies, components of NASDAQ-100 index. 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/indicators such as price to earnings, price to book and current are also incorporated. Consequently, the study uses eight ratios/indicators 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.

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, 2000), (Brigham & 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 deep analysis of profitability (return on equity) is a demanding and complicated process. (Padake & Soni, 2015) and (Herciu, Ogorean, & 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 & 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 are taken 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.

Financial ratios and indicators

A ratio expresses a mathematical relationship between two quantities Babalola & 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 & 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.

Before undertaking any task, it is critical to define following elements:

- The viewpoint taken;
- The objectives of the analysis;
- The potential standards of comparison. Helfert (2001)

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. 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.

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 compute the degree at which either sales or capital is transformed into profits at different levels of the operation. 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 important as they indicate how well the assets of a firm are employed to generate sales and/or cash. 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

Leverage ratio is the degree to which a company uses debt. 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 & 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

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

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. P/E ratio is included in this study as a measure of share value. P/E 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.

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 & 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 & 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 & 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 P & Roaston A (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 & Ogrea (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 & 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 & 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 & 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 & 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 & 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 P/E and profitability (return on equity). The authors conclude that P/E ratio has a U-shaped relationship with ROE meaning that companies with higher forwards P/E 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 P/E ratios.

Katchova & 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 & 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 & 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 & 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 & 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 & 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.

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 capitalization¹. 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. However, some ratios for some companies were not available at 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.

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.

The unit of measure of the variables is either euro amounts or percentages. Formulas depicted in Table 1 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.

¹ <http://www.nasdaq.com/markets/indices/nasdaq-100.aspx>

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

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

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

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.

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).

Empirical Results

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 range² (the difference between the minimum and maximum values of the distribution), the standard deviation and coefficient of variation³ (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 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.

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

Variable	Obs	Mean	Minimum	Maximum	Range	Standard Deviation	Coefficient 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 measurement 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 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.

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.

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.

² Range = Maximum value - Minimum value

³ Coefficient of variation = Mean/Standard deviation * 100

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.

As shown in Table 4, 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, 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 4. Results of the OLS regression analysis, using original measurement units and logarithmic values

Variables	Model 1: Normal values					Model 2: Logarithmic values				
	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

Conclusions, Limitations and Future Research directions

This 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 was 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 as it shows higher value of R-squared compared to the first model. Furthermore, the first model presented Ramsey test value statistically significant which renders the results of the model inaccurate. Therefore, only the results of the second model are considered.

The most important finding of this study is that extended DuPont components are the most powerful drivers of return on equity. The extended DuPont components have enough explanatory power to describe the variations occurring in return on equity. 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.

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,
- 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.

References

- Babalola Y. A., & Abiola F.R (2013). Financial ratio analysis of firms: A tool for decision making. *International Journal of Management Sciences*, 1(4), 132-137.
- Brealey, R. A., & Myers, S. C. (2000). Principles of Corporate Finance. (S. A. Ross, Ed.) Principles of Corporate Finance. McGraw-Hill.
- Brigham, E. F., & Ehrhardt, M. C. (2011). *Financial Management: Theory and Practice*. Mason, Cengage Learning.
- Burja, V., & Mărginean, R. (2014). The Study of Factors that may Influence the Performance by the Dupont Analysis in the Furniture Industry. *Procedia Economics and Finance*, 16, 213-223.
- Delen, D., Kuzey, C., & Uyar, A. (2013). Measuring firm performance using financial ratios: A decision tree approach. *Expert Systems with Applications*, 40(10), 3970-3983.
- Fairfield, P. M., & Yohn, T. L. (2001). Using asset turnover and profit margin to forecast changes in profitability. *Review of Accounting Studies*, 6(4), 371-385.
- Fama, E. F., & French, K. R. (1992). The cross-section of expected stock returns. *The Journal of Finance*, 47(2), 427-465.
- Fama, E. F., & French, K. R. (1993). Common risk factors in the returns on stocks and bonds. *Journal of financial economics*, 33(1), 3-56.
- Fama, E. F., & French, K. R. (1995). Size and book-to-market factors in earnings and returns. *The Journal of Finance*, 50(1), 131-155.
- Godfrey, L. G. (1991). *Misspecification tests in econometrics: The Lagrange multiplier principle and other approaches*. Econometric Society Monographs (Book 16). Cambridge University Press.
- Gujarati, D. N. (2010). Basic econometrics (5th International Edition). New York: McGraw-Hill.
- Hawawini, G. A., & Viallet C. (1999). *Finance for executives: Managing for value creation*. Cincinnati: South Western College Pub.
- Helfert, E. A. (2001). *Financial analysis: Tools and techniques: A guide for managers*. Boston: McGraw-Hill.
- Herciu, M., Ogorean, C., & Belascu, L. (2011). A Du Pont Analysis of the 20 Most Profitable Companies in the World. *2010 International Conference on Business and Economics Research*, 1, 45-48.
- Katchova, A. L., & Enlow, S. J. (2013). Financial performance of publicly-traded agribusinesses. *Agricultural Finance Review*, 73(1), 58-73.
- Li, M., Nissim, D., & Penman, S. H. (2014). Profitability decomposition and operating risk. Retrieved from <https://carlsonschool.umn.edu/file/13416/download?token=A4tP-JRS>
- Liesz, T. J. (2002). Really modified Du Pont analysis: Five ways to improve return on equity. SBIDA Conference Proceedings. Retrieved from <http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.610.5026&rep=rep1&type=pdf>
- Liesz, T. J., & Maranville, S. J. (2011). Ratio Analysis featuring the Dupont Method: an overlooked topic in the finance module of small business management and entrepreneurship courses. *Small Business Institute@ Journal*, 1(1), 17-34.
- Padake, V., & Soni, R. (2015). Measurement of Efficiency of Top 12 Banks in India Using DuPont Analysis. *IUP Journal of Bank Management*, 14(4), 59-68.

- Pech, C. O. T., Noguera, M., & White, S. (2015). Financial ratios used by equity analysts in Mexico and stock returns. *Contaduría y Administración*, 60(3), 578-592.
- Penman, S. H. (1991). An evaluation of accounting rate of return. *Journal of Accounting, Auditing & Finance*, 6: 233-255
- Ramsey, J. B. (1969). Test for specification error in classical linear least squares regression analysis. *Journal of the Royal Statistical Society*, 31, 350-371.
- Reilly, F., & Brown, K. (2012). *Investment analysis and portfolio management*. Mason, Cengage Learning.
- Rostan, P., & Rostan, A. (2012). Assessing the Predictive Power of Customer Satisfaction for Financial and Market Performances: Price-to-Earnings Ratio is a Better Predictor Overall. *International Review of Management and Marketing*, 2(1), 59-74.
- Sahu, P. A., & Charan, P. (2013). *Ratio Analysis is an Instrument—for Decision Making-A Study*. *Asian Pacific Journal of Research*, 1(VIII), 36-41.
- Saleem, Q., & Rehman, R. U. (2011). Impact of Liquidity Ratios on Profitability. *Interdisciplinary Journal of Research in Business*, 1(7), 95-98.
- Soliman, M. T. (2004). Using industry-adjusted DuPont analysis to predict future profitability. Retrieved from <http://ssrn.com/abstract=456700> or <http://dx.doi.org/10.2139/ssrn.456700>
- Soliman, M. T. (2008). The use of DuPont analysis by market participants. *The Accounting Review*, 83(3), 823-853.
- Taani, K., & Banykhaled, M. H. H. (2011). The effect of financial ratios, firm size and cash flows from operating activities on earnings per share:(an applied study: on Jordanian industrial sector). *International Journal of Social Sciences and Humanity Studies*, 3(1), 1309-8063.
- Verbeek, M. (2008). *A guide to modern econometrics* (4th Edition). Chichester: Wiley.
- Wooldridge, J. M. (2012). *Introductory econometrics: A modern approach* (5th Edition). South-Western College Publications.
- Wu, W8. T. A. (2014). The P/E Ratio and Profitability. *Journal of Business & Economics Research (Online)*, 12(1), 65-76.